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CONTENTS

ORIGINAL PAPERS
Changes in Refractive State After the Age of Forty-Five. *Monroe J. Hirsch* ... 229
The Raubitschek Astigmatism Test. *Jess B. Eskridge* ... 238
Contact Lenses in Constant Use for a Three Month Period. A Case Report. *Ramie B. Dick* ... 248
Optometric Findings on Identical Twins. *Theodore Grosvenor* ... 250
An Approach to Prescribing Corneal Type Contact Lenses. *Harold I. Moss* ... 262

ANNOUNCEMENTS
Summer Post-Graduate Courses at Illinois College ... 237
Summer Post-Graduate Courses at Los Angeles College ... 247
Second Course in Contact Lens Fitting at Indiana University ... 250
Beta Sigma Kappa to Meet in Washington ... 261

CORRESPONDENCE
Bibliography of Medical Reviews. *Seymour I. Taine* ... 269

EDITORIALS
Attend the A.O.A. Congress in June. *Carel C. Koch* ... 270
The Sociedad Americana de Oftalmologia y Optometria. *Raymond R. Roy* ... 271

BOOK REVIEWS
Visual Analysis Handbook II. by Leon Manas. *Monroe J. Hirsch* ... 272
Principles of Perception. by S. Howard Bartley. *Rudolph H. Ehrenberg* ... 275
Optical Aids for Low Acuity. by Russell L. Simson. *V. J. Ellerbrock* ... 276
A Guide to Statistical Calculations. by Harold E. Yuker. *Thomas H. Eames* ... 277
Ocular Anatomy. by J. D. Sponner. *H. S. Wodis* ... 278

CURRENT COMMENTS ... 279-280

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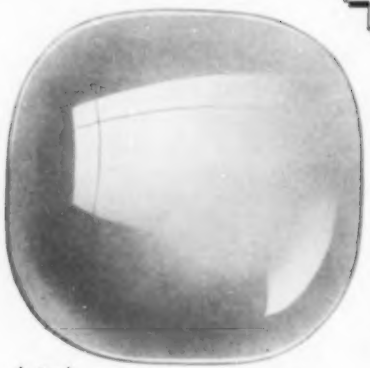

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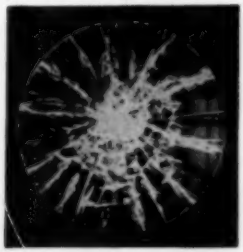

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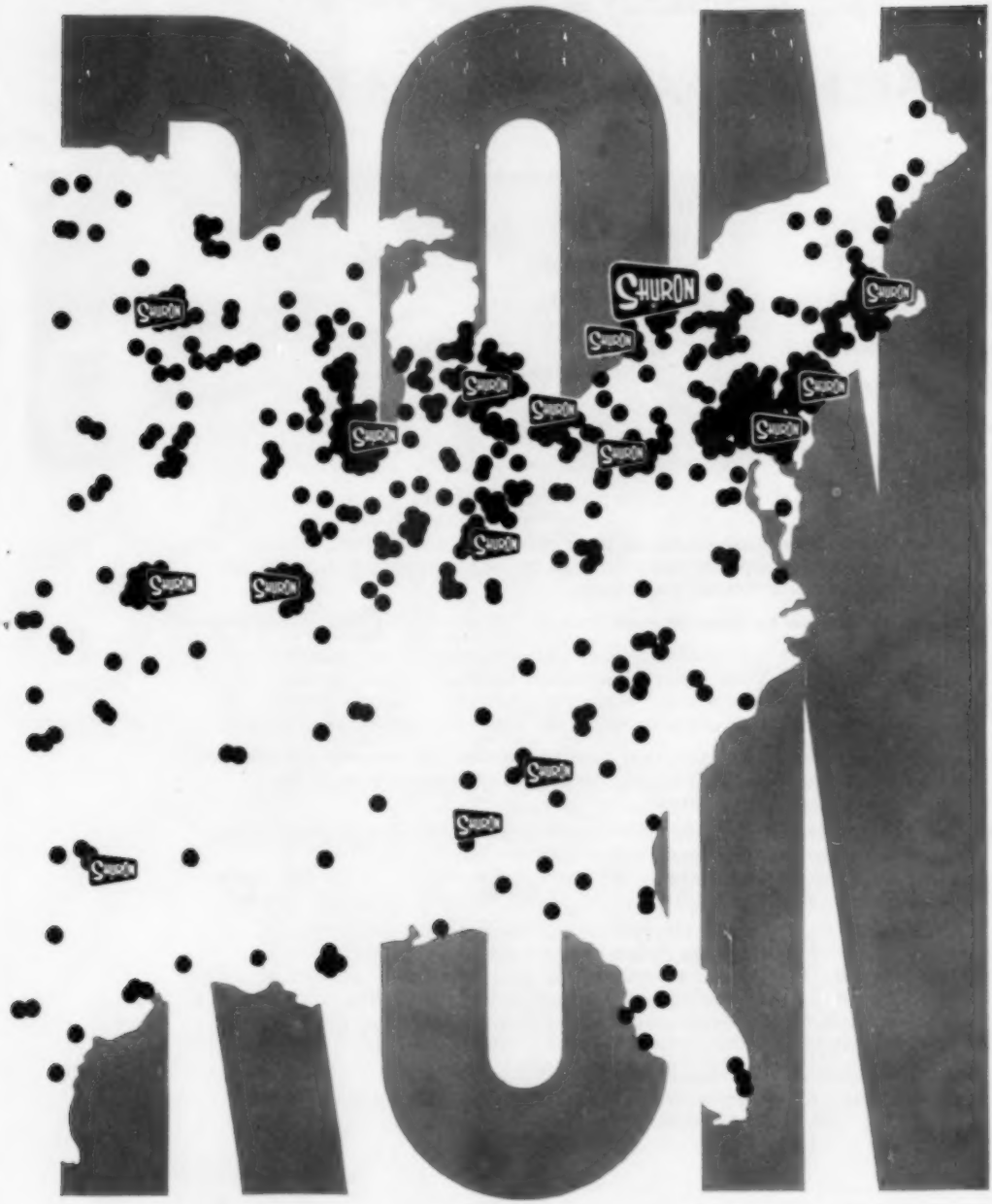

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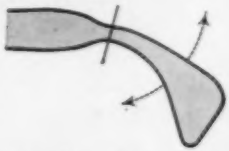

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CHANGES IN REFRACTIVE STATE AFTER THE AGE OF FORTY-FIVE*

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School of Optometry, University of California
Berkeley, California

We feel that the topic which we have chosen for this first Thomas H. Peters Memorial Lecture in Optometry is most appropriate in that it includes both refractive state and geriatrics. In recent years there has been a great widening of the optometric horizon and optometry in the United States now includes in its scope much more than just the measurement and correction of refractive errors. The modern optometrist is interested in psychology, education, particularly as it affects the vision of his younger patients, visual training and visual re-education, problems in illumination, problems of industry in so far as use of the eyes is concerned, reading problems and training, devices for increasing the usefulness to society of persons with subnormal vision, aniseikonia, contact lenses, and many other facets of the profession which were unknown or not practiced fifty years ago. Yet, the optometrist spends the vast majority of his time in measuring and correcting refractive errors. More than half of all of the prescriptions for corrective lenses written in the United States are written by optometrists. The optometrist through his intensified study of refraction has steadily gained social acceptance, and a truly useful profession to society has been developed. There is no question but that all of the aspects of present day optometry are important. However, sometimes optometrists, in their desire to show how broad is the scope of optometry, lose sight of the fact that for the most part the practice of optometry still consists

*This paper is one part of the first Thomas H. Peters Memorial Lecture delivered at the University of California, Berkeley, California, October 19, 1957. This lectureship, the first of its kind in optometry, is to be awarded annually, the lecture to be delivered at the University of California. The lectureship is in memory of Thomas H. Peters, O.D., past president of the California Optometric Association who, more than any other individual, made possible the School of Optometry building on the Berkeley campus. The lecture as originally delivered was a discussion of refraction in general with special emphasis on the changes occurring in later life. The present published paper, which was delivered at the annual meeting of the American Academy of Optometry, Chicago, December 10, 1957, is the experimental data, the conclusions pertaining to geriatric optometry only. The remaining parts on refraction in general will be published in another form. For publication in the May, 1958, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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of treating, through the use of corrective lenses, errors of refraction, and that in performing this service, the optometrist is indeed practicing a most useful profession. We feel, therefore, that in presenting this first Thomas H. Peters Memorial Lecture, one aspect of the refractive state is a fitting subject.

As the life span increases and as advances in medical science make it possible for older people to continue to perform useful tasks, the problem of aiding these people optically becomes increasingly important. In the past few years optometrists have become aware of the fact that geriatrics, or the problems of older people, should be studied in so far as vision is concerned. Although a number of papers have appeared, surprisingly enough, most of the problems have not yet been approached. The present paper is an attempt to begin to study just one of the many aspects of visual problems encountered by the older patient. Thus, the topic we have chosen emphasizes the optometry of tomorrow, a subject selected as the theme for this meeting, but does not lose sight of the optometric heritage and of the fact that optometry yesterday, today, and tomorow, had, has, and will have refraction as one of its basic and most important components.

HISTORICAL DISCUSSION

As in most refractive studies, an historical review best begins with Donders.[1] A tendency for persons past the age of 45 to become more hypermetropic was described by Donders and this phenomenon was named by him "Hypermetropia Acquisita." Seeking to explain the cause of this anomaly, Donders attributed it to "a more uniform firmness of the several layers of the lens, the outer layers becoming more solid, . . . and the lens appears to become flatter." Donders questions whether this change in hypermetropia occurring later in life might not be the result of latent hypermetropia becoming manifest and concludes that this is not the case, his reasons being that hypermetropia had been observed by him to develop in a relatively short time and also that the same sort of change occurred in patients with myopia.

The same phenomenon of acquired hypermetropia has been described by other authors. Duke-Elder[2] states that: "In the fourth decade there is a slight decrease in refractive power (a hypermetropic shift) due to a persistence of the same developmental changes in the lens which compensated for the early increase in axial length . . . . Thus, an eye which is emmetropic at 30 years of age will show 0.25 diopter of hypermetropia at 55, and addition of 0.75 diopter may be evident at 60, of 1.00 diopter at 70, and at 80 years this may increase to about 2.5 diopters. Hypermetropia of this origin is frequently designated acquired hypermetropia.' . . . ."

Tassman,[3] who studied a large number of refractions which he analyzed, found a similar trend toward hypermetropia in older age groups and stated that at age 60 both myopia and hypermetropia increase (although his data show only small changes in this direction). This he states is "in accord with the general feeling that this occurs due to pronounced changes of the crystalline lens." Slataper,[4] who also studied the results of a large number of patients, describes "hypermetropia of middle age" and felt that it occurred between the ages of 31 and 64 years and that its total amount was an average increase of hypermetropia of +1.36 D., or approximately +0.04 D. per year. More recently, Walton[5] has performed a longitudinal study of a large number of patients. The same patients were examined at an earlier and later date, the time between examinations varying from five to 39 years. On the basis of his data, Walton concluded that there was an increase in hypermetropia of between +0.25 and +0.37 D. per ten-year period. This increased hypermetropia was found in all of the age groups.

There seems, then, to be good agreement among the various authors as to the existence of the phenomenon of acquired hypermetropia, but not close agreement as to either the degree of the change nor the age at which the change occurs most markedly. There is also poor agreement as to the cause of the change, as will be shown subsequently. The major aim of the present paper is to attempt to determine more closely the age at which the change occurs, and its degree, and to see if this will not throw some light on the possible cause of the phenomenon.

It was mentioned earlier that Tassman spoke of a shift also toward more myopia among older people. This change, however, Walton failed to find and stated that "Our limited number of findings above age 60 show, however, a decrease in myopia which differs from their (Jackson[6] and Tassman) findings." Slataper did find such a change and describes it as occurring between the ages of 65 and 87 and as being —2.37 D. for the average. Thus, between the ages of 65 and 87 there is a shift of —0.10 D. per year.

The definitive study to date upon this phenomenon is that of Taketa.[7] Taketa analyzed hospital records of 500 patients who had had cataract surgery. The total number of lens extractions was 719, of which number there were preoperative and postoperative refraction data for 250. Of this group, in 50 individuals a number of preoperative refraction findings were available, and these 50 records were carefully studied by Taketa. He concluded the following: "It was

noted that all cataracteous lenses did not alter in refracting power . . . some increased in power, others either decreased or remained rather constant. It seemed that the patients who showed either a sudden increase in magnitude of myopia or a sudden change towards myopia usually had their diseased lenses extracted within 2 or 3 years after the changes were first noted."

In general, this increase in myopia, then, is found by some authors, while others do not find it. It is probably a change of later life than the hypermetropic shift, and probably occurs in certain individuals only, which would account for some authors finding it and others not. When this myopic shift is observed, however, it may precede by two or three years an operable or ripe cataract.

PRESENT EXPERIMENT

The subjects were 820 patients over the age of 45 seen in a private optometric practice in a small town. There were 460 women and 360 men, a difference significant to the one in a thousand level. This difference is, probably, partly a reflection of the greater longevity of women, but also is most likely affected somewhat by sampling since there was a similar difference in the numbers of each sex for each age group except the oldest. As is frequently the case in a small town which is reasonably close to a larger center at which many of the men work, most of the women tend to seek eye care at home while a good portion of the men obtain their visual care in the city in which they are employed. Since no obvious sex differences with respect to the parameter being investigated were encountered, the data for men and women were combined.

It is felt that the sample is fairly representative of the general population since, by the age of 45, most people carrying on normal literate activities find it necessary to have some help either in distant or near seeing or both. In a small town where the optometrist knows most of the people, he is reasonably able to tell how nearly representative of the total population his practice is. We feel, but cannot prove, that the sample used here is as representative as can readily be obtained.

The subjective test which gives the best acuity was used as the measure of the refractive state. This author's technique in subjective testing is such as to find the greatest amount of convex lens power for the maximum acuity with emphasis, however, on maximum acuity. The equivalent sphere for each eye was determined and these two values averaged. This average (for the two eyes) equivalent sphere is one frequently used in refractive studies. A study of the changes in degree and axis of astigmatism in this same age range would be worthy of consideration but is not included in the present study.

The basic data, then, consist of two simple variables, age and refractive state, for a group of 820 individuals. The data were analyzed by constructing frequency distributions for each five-year-age-group. From these distributions the medians and interquartile ranges were calculated, and these are presented in Table I. It will be noted that the median shows a systematic increase in hypermetropia with age. The dispersion, as measured by the interquartile range, increases systematically and, at the older ages here investigated, is more than twice the magnitude in the younger group.

TABLE I

Central Tendency and Dispersion in Refractive State for each Age Group

Age	Number	Median	I. Q. Range
45 - 49	179	+0.18	1.00
50 - 54	162	+0.31	1.31
55 - 59	118	+0.74	1.56
60 - 64	107	+0.84	1.58
65 - 69	82	+0.94	1.69
70 - 74	80	+1.04	1.90
over 75	92	+1.02	2.27

By considering both the dispersion as well as the measure of central tendency, some idea of the changes in individuals may be gained which would be overlooked if only the averages were considered. This simple statistical concept is worthy of stress for it is often overlooked by many writers. Let us assume, for example, that with increased age some people become more hypermetropic while others become more myopic. To make the example clear, let us further assume that every person changes, and that half become more myopic while the other half become more hypermetropic; and let us, to make our example more striking, assume that the changes are equal in degree. The average now would show no change, and based upon the average alone we would state that "on the average no change in refraction occurred with increased age." Yet we assumed in setting up the example that every person changed. We arrive then at the ludicrous statement that the average does not change in a situation in which every person changes. This fact would have been clear from the measure of dispersion which would have shown steady increase.

In this light, we may state of the results in Table I that the tendency toward hypermetropia exceeds that toward myopia up to the age of 75. Now, comparing the last two ages considered, it is seen that the median hardly changes. However, the I. Q. range increases markedly. This would indicate that decided changes of individual refraction are occuring but that there is about as much increase in one direction as there is in the other. This fact will be more clearly shown in

the subsequent table, but the point is made here, if for no other reason, as a warning to those working with data like these, that the average alone is sometimes misleading and fails to show the true picture.

Before leaving the consideration of averages, the data of the present study may be compared to those for other studies. It was pointed out that with regard to the hypermetropic shift, Walton found it to be about 0.025 to 0.037 D. per year and Slataper about 0.04 D. per year. In the present data, if we consider the 25 year span from age 47.5 (the midpoint of the first group) to 72.5, we find the median increasing from +0.18 to +1.04, or a total of 0.86 D. This would be 0.034 D. per year, a figure very close to the higher value found by Walton, and not too far from the value found by Slataper. Closer inspection, however, reveals that the greatest jump occurs between the second and third age group. Calculations reveal that the change seems to be close to 0.02 per year except during the ages of about 52 to 57 (midpoints of second and third group) when the average increase in hypermetropia is between 0.08 and 0.09 per year.

It will also be noted that neither Walton nor Slataper mention the hypermetropic change occurring more at one age than at another although Duke-Elder's theoretical example does show a rapid change between ages 55 and 60 (as do the present data) and again between 70 and 80. In so far as we can generalize from the present data, they seem to indicate (a) that the phenomenon of acquired hypermetropia does exist; (b) that it seems to occur at all ages past 45, but most rapidly between the ages of 50 and 60; and (c) that the average rate of change is close to 0.02 D. per year except within the above age range, at which time it seems to be considerably greater.

Another way of considering the same data is to determine the percentage of patients in each age group who have each of a number of refractive states. For this analysis, the range of refractive states was divided into five groups as shown in Table II. From inspection of this table, we observe the following trends:

(a) The percentage of individuals with myopia in excess of 3.38 D. varies between one and two percent for the group up to age 60. A slight increase is noted at ages 60 - 75 and then a marked increase after age 75.

(b) The percentage of the group with lower degrees of myopia remains constant at approximately four to five percent until age 65, at which time a moderate increase in percentage is noted.

(c) If these two columns are combined, there is a decided increase in the number of patients with myopia after approximately 65

TABLE II

Percentage of People having various Refractive States

Age	Higher Myopia (1)	Lower Myopia (2)	Approx. Emmetropia (3)	Lower Hyperopia (4)	Higher Hyperopia (5)
45 - 49	1.7	5.0	77.2	15.7	0.6
50 - 54	1.2	5.0	70.4	21.0	2.5
55 - 59	0.8	4.2	59.3	30.4	4.9
60 - 64	2.8	4.6	52.3	37.3	2.8
65 - 69	3.7	8.5	43.9	40.3	3.6
70 - 74	1.3	7.5	43.8	41.3	6.4
Over 75	8.7	6.6	36.9	38.1	9.8

(1) Myopia over 3.38 D.
(2) Myopia between 1.13 D. and 3.37 D.
(3) Hyperopia or myopia of less than 1.12 D.
(4) Hyperopia between 1.13 D. and 3.37 D.
(5) Hyperopia over 3.38 D.

years of age. The phenomenon of increased myopia described by Slataper, Duke-Elder, and Taketa is thus confirmed. It has been noted that Walton did not find this trend. Furthermore, the trend was more marked in Slataper's data than in the present author's. Sampling errors may account for these differences. Since Slataper's data were obtained from opthalmological records, there would be a greater number of patients with cataract. However, he states that all patients with any "diseased eye" were omitted from the study and that only those with good acuity were included. It might also be argued that the phenomenon is obscured in Walton's data because he used averages. This, however, is also not a satisfactory explanation since Walton's table showing specific changes also fails to reveal any such trend. At this moment the reason for the lack of agreement among different investigators is obscure.

(d) As age increases, the number of emmetropes diminishes markedly. Inspection of the table shows that this is due to an increase in the number of both myopes and hypermetropes.

(e) The increase in hypermetropia from age 45 to 75 is marked. If we combine the last two columns of Table II, we find that the number of hypermetropes in excess of +1.12 D. is twice as great in the 55 - 59 age group as in the 45 - 49 group and three times as great in the groups over 70 years of age.

The present data indicate that many patients become more hypermetropic between the ages of 45 and about 60. Past 60 there is still some trend toward hypermetropia, and after the age of about 65 some individuals also show a trend toward myopia. The cause of these phenomena and their theoretical implications will not be discussed in the present paper. However, certain practical applications of the data to optometric practice may be mentioned briefly.

(1) Although a patient of age 50 or so is given a reading addition of +2.00 or +2.25 D., the optometrist should be wary of stating that these lenses will now serve for many years. It is not uncommon to have such patients experience a recession of the near point a year or two later and to require a correction for a greater degree of hypermetropia with the same reading addition. In the past some refractionists, after prescribing a reading addition of 2.50 D., have told the patient that this is probably "the last change we shall have to make." Such a statement is never warranted and, as the present evidence indicates, is frequently not true.

(2) Optometrists who recall their patients by notices find that it is best if the patient is re-examined at a date when there is a good expectation that a lens change will be required. Changes in refraction are marked a few years before and after puberty, and some patients should be re-examined frequently during this period. From the age of, roughly, 20 to 40 there are few changes, and the same lens prescription may be used for a longer period of time than at any other period of life. After 45, however, changes of both the accommodative mechanism and of the refractive state occur, and re-examination should again be more frequent. The optometrist, knowing what changes might be expected, will be enabled to set up a workable and practical recall system.

(3) Patients appreciate and are entitled to an intelligent discussion of their anomaly and some indication of what changes they might expect in the future. The patient is spared a good deal of worry and concern if he has been told that his vision may again change and what this means. On the basis of these results, it would seem that patients prior to age 60, regardless of the state of the accommodative mechanism, may be warned that the near point may again recede and that, in addition, distance blurring may be experienced. Patients after the age of 65, and particularly those with any lenticular pathology, should be told that distance blurring may appear after a time.

(4) Patients in the older age groups frequently manifest a slowing of mental processes, denser media and smaller pupils making for poor retinoscopic reflexes, and deafness. All of these things make subjective testing difficult, and a different technique from that used on younger patients is often required. The optometrist who knows about what changes he may expect will have a much easier time. Frequently, with such patients, the subjective examination can consist of little more than trying four or five moderate lens changes over and over again. With such patients one is far better able to arrive at a satisfactory solution of the problem by knowing the type of changes which might occur

and then trying these than by attempting to do a precise and unbiased test.

REFERENCES

1. Donders, F. C., On the Anomalies of Accommodation and Refraction of the Eye. London, The New Sydenham Society, 1864.
2. Duke-Elder, W. Stewart. Text-book of Ophthalmology. Vol. 4. St. Louis, Mo., C. V. Mosby Co., 1949.
3. Tassman, I. S., Frequency of various kinds of refractive errors. Am. J. Ophth., 15:1044-1053, 1932.
4. Slataper, F. J., Age norms of refraction and vision. Arch. Ophth., 43:466-481, 1950.
5. Walton, William G., Jr., Refractive changes in the eye over a period of years. Am. J. Optom. and Arch. Am. Acad. Optom., 27 (6):267-286, 1950.
6. Jackson, Edward. Norms of refraction. J. Am. Med. Assn., 98:132-137, 1932. (Original not examined.)
7. Taketa, Shyojiro Tom, The Relation of the Crystalline Lens to the Refractive State of the Eye. Unpublished Master's Thesis, Stanford University, 1949.

ANNOUNCEMENT

SUMMER POST-GRADUATE COURSES AT ILLINOIS COLLEGE

A six day post-graduate program at the Illinois College of Optometry, Chicago, will be held August 10-15, 1958. The courses will include both Visual Training and Ocular Pathology. The courses will be so scheduled that each registrant will be able to attend each session during the six day period.

Dr. M. E. Van Orden, Ithaca, New York, will present a three day course on visual training techniques. The course will include demonstrations providing the optometrist with his latest techniques in orthoptics.

The three day course in ocular pathology will be presented by Dr. R. H. Levy, Dr. P. F. Shulman and Dr. R. Teshima of the college faculty and Dr. J. H. Prince of the Ohio State University. The lectures will be divided among these educators and will include a review of ocular manifestations of general diseases, diseases of the external and internal eye, tonometry, and examination and interpretation of the visual fields. Clinical instruction will supplement the course lectures in the College Pathology Clinic.

Each course is limited to 50 optometrists and will be filled in the order the registrations are received. Registration for each course is $50. All optometrists are invited to enroll. For further information or advanced registration, write to the dean, Dr. Alfred A. Rosenbloom, Illinois College of Optometry, 3241 S. Michigan Avenue, Chicago.

THE RAUBITSCHEK ASTIGMATISM TEST*

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College of Optometry, University of Houston
Houston, Texas

INTRODUCTION

The use of line charts has probably been one of the most frequent subjective methods utilized for the detection and measurement of astigmatism. Many different types of line charts have been designed with the idea of simplifying the appearance of the target while keeping the target as effective as possible. These designs have varied from the "fan dial," with a line at every ten degrees, to the "revolving cross," which is composed of only two lines. (Figure 1.) The "fan dial"

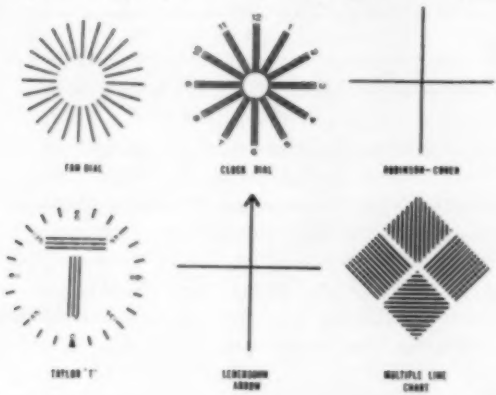

Fig. 1

type chart complicates the target's appearance with too many lines. The "revolving cross" reduces this obstacle, yet it is still practically unsatisfactory, since this chart at any one position tests only two of the many possible meridians.

Raubitschek developed a target with unique characteristics which has alleviated this problem. The target contains only two lines, yet has target detail in all of the possible meridians. The two lines form

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a type of opened end arrow head, each wing being a section of an approximate parabolic curve. The two wings begin in the same meridian as parallel lines and end in the same meridian as widely separated lines each turning through an angle of ninety degrees in the opposite direction. With this shape, the target contains detail in all the existing meridians. (Figure 2.) Therefore, for an astigmatic eye,

Fig. 2

regardless of the target orientation, the major meridian or the meridian of greatest refracting power of the eye will be represented in the target by a specific section of one of the wings.

METHOD OF CYLINDRICAL AXIS DETERMINATION

With the static skiametry finding in the refractor (excluding the cylindrical component) increase the spherical lens power by +0.50 D.S. to achieve a slight "fogging" effect. Present the Raubitschek test chart to the patient monocularly. If astigmatism is present, one of the wings of the arrow will contain a relatively clearer or darker section, called a "shadow." The section of the curve corresponding to the "shadow" is parallel to the major meridian or the meridian of the greatest refracting power of the eye. (Figure 3.)

If a "shadow" is present, indicating an astigmatic eye, rotation of the arrow will cause a change in the position of the section of the curve which is parallel to the major meridian; and consequently, this rotation will cause a change in the position of the "shadow." Thus, in

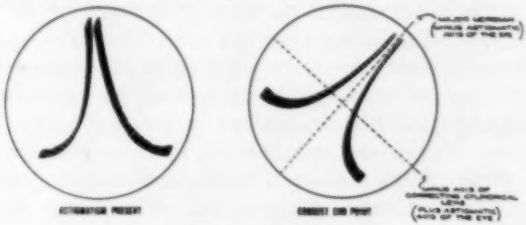


Fig. 3

cases of astigmatism, the rotation of the target produces a continuous change in the "shadow's" position on the target. Due to the shape of the curve, this change is gradual when the target is pointed away from the major meridian, but increases rapidly as the target is moved toward the major meridian. This variation of velocity in the "shadow's" movement gives the target increased sensitivity in locating the major meridian. The movement of the "shadow" and the target's sensitivity may be demonstrated by viewing the target monocularly through a high plus cylindrical lens and rotating either the target or the lens.

To determine the location of the minus axis of the correcting cylindrical lens, rotate the target (causing the "shadow" to move) until the two parallel tips of the arrow are seen as being equally distinct. In making the comparison between the two wings of the arrow, the patient compares what he presently sees and does not have to rely on his visual memory to determine equality. The target is rotated in the direction of the less distinct wing to obtain the correct end point. A slight discrepancy in location of the major meridian is indicated by one wing being seen slightly longer at the tip than the other when the target is very near the correct end point. The parallel tips, at this correct end point, are in the meridian of the greatest refracting power of the eye and the cylindrical correction lens will have its minus axis located 90° away. (Figure 3.) This same procedure is repeated for the fellow eye.

METHOD OF CYLINDRICAL POWER DETERMINATION

There are four methods which can be utilized in determining the proper cylindrical correction lens power.

The Raubitschek Method: Raubitschek's method utilizes the concept of obliquely crossed cylinders and their effect upon the position of the resultant cylindrical axis to determine the cylindrical lens power correction for the eye. In this procedure, the minus axis of a cylindrical lens of known power is placed at a predetermined angular deviation from the measured minus astigmatic axis of the eye, and the resultant shift in the minus axis of the system, produced by the combination of the known cylindrical lens and the cylindrical power component of the eye, is determined. After the addition of the known cylindrical lens, the shift in the resultant minus axis of the system is measured by determining the angular rotation of the target, from the major meridian, necessary to cause the "shadow" to reappear equally distinct on the parallel tips of the arrow. By using tables similar to Tables 1-6, or a nomograph, the refractionist is able to determine the amount of the cylindrical refractive power correction for the eye.

TABLE 1

0.50 D.C. with its minus axis 40° from the minus astigmatic axis of the eye (Major Meridian)

Target Rotation from the major meridian	Cylindrical Correction lens
27.82°	—0.25
20.00°	—0.50
15.24°	—0.75
12.19°	—1.00
10.11°	—1.25
8.62°	—1.50
7.50°	—1.75
6.64°	—2.00

TABLE 2

1.00 D.C. with its minus axis 40° from the minus astigmatic axis of the (Major Meridian)

Target Rotation from the major meridian	Cylindrical Correction lens
27.81°	—0.50
23.42°	—0.75
20.00°	—1.00
17.34°	—1.25
15.24°	—1.50
13.56°	—1.75
12.19°	—2.00
11.06°	—2.25

TABLE 3

1.50 D.C. with its minus axis 40° from the minus astigmatic axis of the eye (Major Meridian)

Target Rotation from the major meridian	Cylindrical Correction lens
27.81°	—0.75
24.76°	—1.00
22.18°	—1.25
20.00°	—1.50
18.16°	—1.75
16.58°	—2.00
15.24°	—2.25
14.08°	—2.50
13.07°	—2.75
12.19°	—3.00

An example may well serve to illustrate the use of this method. Assume that the major meridian for the left eye was found, by the method described above, to be located at 155°. (This indicates that the minus axis of the correcting cylindrical lens will be located at 65°.) Remove the "fogging lens" from the refractor, leaving the sphere that allows the patient to obtain maximum visual acuity. Place the minus axis indicator for the cylindrical lenses in the refractor 40° from the major meridian, at 115° for this case, and add a —1.00 D.C. lens.

TABLE 4

2.00 D.C. with its minus axis 40° from the minus astigmatic axis of the eye (Major Meridian)

Target Rotation from the major meridian	Cylindrical Correction lens
25.48°	—1.25
23.42°	—1.50
21.60°	—1.75
20.00°	—2.00
18.59°	—2.25
17.34°	—2.50
16.23°	—2.75
15.24°	—3.00
14.35°	—3.25
13.56°	—3.50

TABLE 5

2.50 D.C. with its minus axis 40° from the minus astigmatic axis of the eye (Major Meridian)

Target Rotation from the major meridian	Cylindrical Correction lens
24.21°	—1.75
22.66°	—2.00
21.26°	—2.25
20.00°	—2.50
18.86°	—2.75
17.82°	—3.00
16.88°	—3.25
16.02°	—3.50
15.24°	—3.75
14.52°	—4.00

TABLE 6

3.00 D.C. with its minus axis 40° from the minus astigmatic axis of the eye (Major Meridian)

Target Rotation from the major meridian	Cylindrical Correction lens
21.05°	—2.75
20.00°	—3.00
19.04°	—3.25
18.15°	—3.50
17.34°	—3.75
16.58°	—4.00
15.88°	—4.25
15.24°	—4.50
14.64°	—4.75
14.08°	—5.00

Have the patient view the Raubitschek target and observe that the "shadow" is no longer located on the parallel tips of the arrow. Rotate the arrow toward the minus axis of the added cylindrical lens, toward the 115° meridian of the eye for this case, and ask the patient to report when the "shadow" reappears equally distinct on the parallel tips of the arrow. Assume that the target rotation from the major meridian

necessary to accomplish this was about 17°. Using Table 2 we obtain the cylindrical correction lens power of —1.25 D.C. The final cylindrical correction lens would then be, —1.25 D.C. axis 65°.

This result could also be determined by using a —0.50 D.C. and Table 1, —1.50 D.C. and Table 3, or —2.00 D.C. and Table 4. This versatility in testing procedure increases the possibility of more accurately measuring the cylindrical refractive error.

The Pascal Method: Pascal has proposed a slightly different procedure which also utilizes the concept of obliquely crossed cylinders. In this method, the Raubitschek arrow is rotated to a specified angular position from the major meridian, and then minus cylindrical lenses are added, in the refractor, at another specified angular position, until the resultant cylindrical axis of the system (the eye and the added cylindrical lens) is coincident with the position of the arrow. The power of the cylindrical lens required to achieve the proper shift of the resultant axis and bring it coincident with the position of the arrow is the cylindrical correction lens for the patient. This correction lens is determined subjectively by that cylindrical lens which equalizes the "shadow" on the parallel tips of the arrow.

As an example, assume that the major meridian was found to be located at 180°. The cylindrical lens necessary to correct this error would have its minus axis at 90°. The arrow is now rotated 30° toward the minus axis of the correcting cylindrical lens, that is, to the 150° meridian. This angle is called the "rotation angle." The cylindrical lens axis indicator on the refractor is rotated 30° from the minus axis of the correcting cylindrical lens toward the major meridian, that is, to the 120° meridian. This angle is called the "test angle." (Figure 4.)

Assume that 1.00 D. of astigmatism exists. In this case the hori-

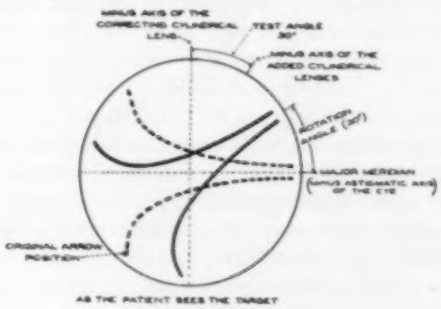
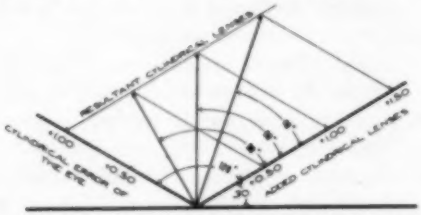


Fig. 4

zontal meridian of the eye would have a differential power of +1.00 D. This refractive error could be represented by a 1.00 D.C. lens with its plus axis at 90°. If we add —0.50 D.C. axis 120° by the refractor the cylindrical lens resulting from this cylinder and the cylindrical component of the eye will be: —0.88 D.C. axis 165°. (Figure 5.)



CYLINDRICAL ERROR OF THE EYE	ADDED CYLINDRICAL LENS	RESULTANT CYLINDRICAL LENS
+1.00 D.C. ax 90	(−0.50 D.C. ax 120)	(+0.88 D.C. ax 75)
	+0.50 D.C. ax 30	−0.88 D.C. ax 165
+1.00 D.C. ax 90	(−1.00 D.C. ax 120)	(+1.00 D.C. ax 60)
	+1.00 D.C. ax 30	−1.00 D.C. ax 150
+1.00 D.C. ax 90	(−1.50 D.C. ax 120)	(+1.38 D.C. ax 50)
	+1.50 D.C. ax 30	−1.38 D.C. ax 140

Fig. 5

The major meridian of the system would now be located at 165°, and consequently, the section of the target located in this meridian would contain the "shadow." It is evident from the above position of the arrow that the "shadow" would be located on the upper wing. (Figure 6.)

If we add —1.50 D.C. axis 120° by the refractor the resulting cylindrical lens would be: —1.38 D.C. axis 140°. (Figure 5.)

The major meridian of the system would now be located at 140°, and so the section of the target located in this meridian would contain the "shadow." With the arrow in the above position, the "shadow" would be located on the lower wing. (Figure 7.)

If we add —1.00 D.C. axis 120° by the refractor the resulting cylindrical lens would be: —1.00 D.C. axis 150°. (Figure 5.)

The major meridian of the system would now be located at 150°. Since this coincides with the position of the arrow, the parallel tips of the arrow would appear equally distinct. (Figure 8.) The —1.00 D.C. is therefore the proper cylindrical correction lens power and the cylindrical correction lens would be: —1.00 D.C. axis 90°.

It is evident from the above that if the added cylindrical lens power is *too high*, the arrow wing which is more *remote* from the cor-

Fig. 6. upper left. Fig. 7. upper right. and Fig. 8. lower center.

recting cylindrical lens' minus axis will contain the darker section and, therefore, the added cylindrical lens power must be *reduced* to obtain the correct end point. If the added cylindrical lens power is *too low*, the arrow wing which is nearer the correcting cylindrical lens' minus axis will contain the darker section, and, therefore, the added cylindrical lens power must be *increased* to obtain the correct end point.

To determine the proper "test angle" and "rotation angle" that are utilized in this procedure, an arbitrary "test angle" is selected and then the "rotation angle" is calculated using the following formula:

$$\text{Rotation Angle} = \frac{90^\circ \text{ Test Angle}}{2}$$

As stated previously, Pascal's method is based on the concept of obliquely crossed cylinders, i.e., two obliquely crossed cylindrical lenses of equal power will yield a resultant cylindrical lens whose axis is halfway between the axis of the two component cylindrical lenses. (Figure 5.) Therefore, if the cylindrical error element of the eye is to be determined, we select some axis at which cylindrical lenses are to be added (test angle) then place the arrow in the meridian which bisects the angle between the minus cylindrical error axis of the eye and the minus axis of the measuring cylindrical lenses (rotation angle). The added cylindrical lens power which causes the resultant axis to move to a position halfway between its own axis and that of the eye (determined by that cylindrical lens power that brings about maximum equal clarity of the parallel arrow tips as in Figure 8) is thus equal to the cylindrical refractive error of the eye.

The greater the distance the "shadow" is from the parallel tips of the arrow, the greater the difference between the present cylindrical lens power and the required cylindrical lens power will be. Thus, for small cylindrical refractive errors a "test angle" of 30° is used, for medium cylindrical refractive errors a "test angle" of 20° is used, and for large cylindrical refractive errors a "test angle" of 10° is used. See Table 7.

TABLE 7

	Test Angle	Rotation Angle
Small Cylindrical Ref. Errors	30°	30°
Medium Cylindrical Ref. Errors	20°	35°
Large Cylindrical Ref. Errors	10°	40°

It is evident that optometrists can repeat the test using many different "test angles." This variety also increases the chances of making a more valid determination of the proper cylindrical correction lens power.

The Heath Method: Dr. Gordon G. Heath has proposed a much simpler method of determining the proper cylindrical corrections lens power. He proposes that the axis indicator on the refractor be placed at the minus axis of the correcting cylindrical lens, and that the Raubitschek arrow be rotated 20° or 30° away from the major meridian. Cylindrical lenses are then added until the target appears equally distinct in all meridians. The cylindrical lens that accomplishes this is, of course, the correct cylindrical lens power.

A Fourth Method: In this method the axis indicator of the refractor is placed at the minus axis of the correcting cylindrical lens, and the Raubitschek test arrow is rotated 90° away from the major meridian. This will, of course, cause the more widely separated tips of the target to appear darker. This change is made so that a greater proportion of the target will become blurred. This will have the effect of making the cylindrical refractive error more evident and thereby allow a more sensitive and accurate measurement. Cylindrical lenses are then added in the refractor until the target wings appear equally distinct in all meridians. In this method, a comparison between the two extremeties of the target can be made at the end point, thus allowing better results.

DISCUSSION

The theoretical basis for the Raubitschek astigmatism test is very good. Its many advantages and salient features have been discussed in the present paper and in the papers by Pascal. As with most new testing procedures, however, practical problems arise in its application. Some of these are:

(1) The problem of the best target configuration.

(2) The problem of the best target style, i.e., should each wing of the arrow be composed of one, two, or three lines, and should the lines be solid or dotted?

(3) The problem of the best target background.

(4) The effect of the resultant sphere which occurs when two cylindrical lenses are obliquely crossed.

(5) The need for a smooth accurate rotational mechanism for the target.

(6) The need for more tables such as Tables 1 through 6, with angles of 20° and 60° between the component cylindrical lenses.

(7) The problem of obtaining simple and quick communication with the patient.

The solutions to these problems, and others, will come with a continued and more widespread use of the testing procedure.

BIBLIOGRAPHY

Heath, G. G., Personal communication.

Pascal, J. I., A new application of the Raubitschek arrow test. Eye, Ear, Nose, Throat Monthly, 33:473-477, 1954.

Pascal, J. I., The Pascal-Raubitschek test for astigmatism. J. Am. Optom. Assn., 25 (9) : 491-495, 1954.

Raubitschek, E., The Raubitschek arrow test for astigmatism. Am. J. Ophth., 35 (9) : 1334-1339, 1952.

ANNOUNCEMENT

SUMMER POST-GRADUATE COURSES AT LOS ANGELES COLLEGE

The Los Angeles College of Optometry will hold its 12th annual summer session beginning Monday, June 9, through Friday, June 20, 1958.

Courses given the week of June 9 through 13 will be (1) Visual Training in Esophoria, instructor, Harold M. Haynes, O.D., Pacific University, School of Optometry, and (2) Contact Lens Fitting Techniques, instructor, Milton C. May, O.D., Los Angeles college of Optometry.

Courses given the week of June 16 through 20 will be (1) Lectures in Practical Optometry, instructors, Clinic staff and faculty, Los Angeles College of Optometry, and (2) Modern Dispensing Practice, instructor, Margaret S. Dowaliby, O.D., Los Angeles College of Optometry.

Fee for the total course $100 or for individual courses $25 each. For registration write to Frank A. Brazelton, O.D., Los Angeles College of Optometry, 950 W. Jefferson Blvd., Los Angeles 7.

CONTACT LENSES IN CONSTANT USE FOR A THREE MONTH PERIOD A CASE REPORT*

Ramie B. Dick†
Sandusky, Ohio

This report is of interest inasmuch as the patient wore micro-contact lenses for a period of three months without removal.

The patient, a seventeen year old high school student, had been referred to the writer for contact lenses to be used while engaged in basketball and football. His last refraction had been performed one year previously and he presented no symptoms. The patient wanted micro-lenses, even though he was warned that they were more likely to drop out than scleral lenses.

The prescription for his spectacles was:

O.D. +4.00 D.sph. ⌒ —2.75 D. cyl. axis 20 20/20
O.S. +4.50 D.sph. ⌒ —3.00 D. cyl. axis 165 $20/20^{-2}$

The bulbar and palpebral conjuctivas, the eyelids and lashes and external tissues presented no abnormalities. The patient demonstrated a constant right esotropia of 20Δ diopters at 6 m. with his spectacles in place. A diagnosis of right esotropia with anomalous correspondence was made, but the writer will not discuss this problem further since nothing was done about the esotropia as the patient was interested primarily in contact lenses. His interpupillary distance was 67 mm.

The cornea, aqueous, lens and vitreous were clear and free of any apparent pathology. The disk margins were clearly defined with no anatomical or pathological abnormalities. Both disks were classified as having an Elschnig #1 cupping. The eye grounds as well as the blood vessels were normal in all respects. Intra-ocular tension as measured with the Wolfe scleral tonometer was normal. Central and peripheral visual field studies were negative. Color vision was normal.

The findings of the subjective test were:

O.D. +4.75 D. sph. ⌒ —2.50 D. cyl. axis 10°
O.S. +4.75 D. sph. ⌒ —3.00 D. cyl. axis 160°

The ophthalmometer findings were:

O.D. 39.00 D. at 15° ⌒ 41.75 D. at 105°
O.S. 38.75 D. at 160° ⌒ 42.00 D. at 70°

*Submitted on November 12, 1957, for publication in the May, 1958, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
†Optometrist. Fellow, American Academy of Optometry.

The following micro-contact lenses were prescribed:

O.D. size 9.5 mm. radius 9.15 power +7.50
O.S. size 9.5 mm. radius 9.22 power +7.50

The patient was instructed on insertion and removal in two visits and was given his lenses with instruction to wear them two hours the first day and increase it one-half hour daily. Ten days later the patient reported that he was wearing the lenses all day. On two subsequent visits it was determined that both the physical and optical fit were excellent. On the last visit I discovered quite accidently that the patient had been wearing the lenses both day and night. I was able to establish that when he was sleeping, the lenses were riding on the cornea and not on the sclera as some contact lens fitters claim. Upon arising in the morning and opening his eyes, he always found the lenses to be in place. I could not prevail upon him to remove the lenses when he retired, even though I called his mother to ask her cooperation in this matter.

I then corresponded with several men prominent in the contact lens field to determine if they had ever heard of anyone wearing their contact lenses twenty-four hours a day and just what after effects occurred, if any.[1] I discovered that there was no definite report in our literature of people wearing contact lenses twenty-four hours a day, but that Sohnges of Germany had been permitting his patients to do so.

Finally, after three months of constant wear, we prevailed upon this patient to remove his lenses. They were removed for the first time in three months and his cornea was immediately examined with the slit-lamp. The report from the ophthalmological consultant is as follows:

> "Examination 9:30 a.m. immediately after removal of contact lenses O.D. there is a faint nebula involving epithelium and Bowman's zone just above and temporal to the corneal center 2½ × 2½ mm. in diameter. Below and temporal to this there are 2 semi-circular nebulas adjacent to each other about 2½ mm. in length. These also involve Bowman's zone. These areas all stain faintly with fluorescein. Cornea otherwise clear. There are prominent palisades around the entire circumference. The eye is not injected. Anterior chamber, iris and lens appear normal through the undilated pupil. O.S. there are 2 vertically placed adjacent neubulas 2½ mm. in length involving epithelium and

[1]Dr. John C. Neill: Philadelphia, Pennsylvania.
Dr. Newton K. Wesley: Chicago, Illinois.
Dr. William Policoff: Wilkes-Barre, Pennsylvania.

Bowman's zone. These are just below and nasal to the center. Above and temporal to the center are 2 more dense areas of opacity about ½ mm. in diameter. Nasal to these are 8 or 10 very tiny dotlike opacities. These also involve epithelium and Bowman's zone. Corneal palisades are prominent and there are 2 nerves visible in the lower temporal quadrant. Anterior chamber, iris and lens normal through the undilated pupil. The nebulous areas stain faintly with fluorescein."

Examination six hours after slit-lamp examination revealed that the corneal lesions were completely healed. It is interesting to note that even though the lesions were present, the patient was still wearing the contact lenses twenty-four hours a day and reported complete comfort.

The patient has not been seen for six months, but at last report he was still following the advice of removing the lenses upon retiring. There are no statistics in the literature on the twenty-four hour wearer and considerable work must be done in this field before such a practice can be advised clinically. All such cases should be carefully recorded and reported in our literature. Perhaps some day in the future we can predict just what effect their constant use may have on the corneal tissues over a period of many months or years.

1002 W. WASHINGTON STREET
SANDUSKY, OHIO

ANNOUNCEMENT

SECOND COURSE IN CONTACT LENS FITTING AT INDIANA UNIVERSITY

The on campus post-graduate course in "The Theory & Practice of Contact Lenses" offered by the Division of Optometry of Indiana University, on July 9-13, has been filled. A second course therefore has been opened for the following week July 15-19. This course will also be taught by Dr. Neal J. Bailey, O.D., Ph.D., Assistant Professor of Optometry. The course is a 30-hour non-credit course, tuition $60.00.

Additional course offerings on the campus in Bloomington, Indiana, are "Case Analysis," June 4-7, 25 hours non-credit, tuition $50.00, Instructor Merrill J. Allen, O.D., Ph.D., Associate Professor of Optometry; and "Visual Training and Orthoptics," July 14-17, 25 hours non-credit, tuition $50.00, Instructor Gordon G. Heath, O.D., M.S., Assistant Professor of Optometry.

OPTOMETRIC FINDINGS ON IDENTICAL TWINS*

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INTRODUCTION

Identical twins are often used as subjects in investigations to determine whether or not certain traits are genetically-determined, or are determined by environmental factors. Their use as subjects in such investigations stems from the fact that both members of a pair of identical twins originate from one ovum, which splits into two early in its developmental process, causing both members to have the same genotype.[1] One would expect, therefore, that if both members of a pair of identical twins possess a certain trait, this trait would be genetically determined; while if a trait was possessed by one member but not by the other, it would be environmentally determined.

Studies concerning optometric findings on identical twins have been reported by Hofstetter[2] and by Hofstetter and Rife.[3] Hofstetter reported on 30 pairs of identical twins whose A.C.A. (accommodative convergence/accommodation) ratios were computed from findings taken by means of a troposcope. He found the variations in A.C.A. ratios between identical twins to be significantly less than the variations between pairs or families, and concluded that "the high similarity points either to the inference that there is a genetic basis for accommodative convergence or that environmental factors influencing the development of accommodative convergence are remarkably and selectively similar for the two members of each pair." Hofstetter and Rife reported optometric findings on 76 pairs of twins examined at the Ohio State University over a period of several years. Their subjects included both identical and fraternal twins, and they concluded that in all cases the correlation between findings on identical twins was as high or higher than that between findings on fraternal twins.

The present study concerns itself with findings taken on three pairs of identical twins. The optometric findings were included as a part of an overall investigation conducted in the department of Zoology at the Ohio State University under the direction of Edward Les, of that department. The subjects were all college students, and the members

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†Optometrist, Ph.D., Member of faculty, Fellow, American Academy of Optometry.

of each pair were identical in appearance and were determined by Dr. Les to be identical (single-ovum) twins. The optometric testing was done by three senior students at the School of Optometry at the university. Both members of each pair of twins were examined by the same student, and with the same equipment. Each of the three optometry students had completed his clinical requirements, having done approximately 100 examinations, and was therefore qualified to take the optometric findings.

It is of interest to note that, while both members of one of the pairs of twins had never worn spectacles, one member of each of the other two pairs of twins had worn spectacles, while the other had not. In one case the twin who wore spectacles had worn them for four years, while in the other case the twin who wore spectacles had worn them for only four months. These are the first cases in the author's experience in which one member of a pair of twins wore spectacles while the other did not. For example, of the 30 pairs of twins studied by Hofstetter, there were several pairs of which both members had worn spectacles, but none in which one member had worn spectacles and the other had not. The reason for presenting this material evolves mainly upon the fact that this situation existed in regard to the subjects: indeed, the discussion will be aimed toward seeking an explanation as to why one member of a pair of twins may need a correction while the other may not.

PROCEDURE

Although a complete optometric examination was performed on each subject, only those findings which in the writer's opinion are most likely to be genetically-determined will be discussed here. Those to be discussed are the ophthalmometer findings, static retinoscopy, binocular subjective, visual acuity findings, lateral phoria findings at distance and near, the A.C.A. ratio, and color vision findings. The findings were taken as follows:

OPHTHALMOMETER FINDING

The same ophthalmometer was used on each member of a pair of twins. The findings were taken first on the right eye, then on the left eye; following this the findings were retaken in the same order, and the findings averaged if any differences were noted.

STATIC RETINOSCOPY

This finding was taken in the usual manner, the patient fixating an object at a distance of 20 feet, and the optometrist neutralizing the reflex with lenses.

BINOCULAR SUBJECTIVE

Upon completion of the monocular subjective finding, the visual acuities were balanced, and the patient was fogged and gradually brought to his best visual acuity. Specifically, plus lens power was reduced until a reduction of an additional quarter diopter would fail to allow any additional letters to be discerned.

VISUAL ACUITY FINDINGS

Visual acuity was taken in the usual manner, both uncorrected and corrected.

LATERAL PHORIA AT DISTANCE

With the binocular subjective finding in place, the subject's attention was directed to a line of letters at a distance of 20 feet: a dissociating vertical prism was placed before one eye, and a prism base-in was placed before the other: the subject was then instructed to report when the two lines of letters were aligned vertically, as the amount of base-in prism was gradually reduced.

LATERAL PHORIA AT NEAR

The subject's attention was directed to a line of letters at a distance of 16 inches, with the binocular subjective finding in place, and the same technique was used. Each lateral phoria finding was taken twice, and an average taken if any difference was noted.

THE A.C.A. RATIO

The ratio of accommodative convergence to accommodation was determined by the following formula, as described by Fry:[4]

$$\frac{15 + \text{phoria at distance} - \text{phoria at near.}}{2.5}$$

esophoria being considered as a positive quantity, and exophoria as a negative quantity. The number 15 in the numerator indicates the total amount of convergence necessary at 40 centimeters for a person with an interpupillary distance of 60 mm. There is a small error involved if the interpupillary distance is other than 60 mm., but this error is unimportant when comparing identical twins whose interpupillary distances are equal or very nearly so, since the error would have the same effect on the value of the A.C.A. ratio for one twin as it would for the other. The number 2.5 in the denominator denotes the stimulus to accommodation present when a patient views a target at 16 inches (40 cm.) through his distance correction. Since we are dealing with the stimulus to accommodation rather than with the amount of accommodation actually in play, it would be more correct to speak of the ratio of accommodative convergence to the *stimulus* to accommodation.

when we are talking about the clinically-determined A.C.A. ratio. It is, of course, possible to measure the amount of accommodation in play, but this is not ordinarily done in routine clinical optometric practice.

COLOR VISION TESTING

The American Optical Company pseudo-isochromatic plates were used. Each plate was recorded as having been named correctly or incorrectly. Beyond this, no attempt was made to further analyze the status of the subject's color vision.

RESULTS

The examination findings are listed in Tables 1, 2, 3. An analysis of the findings follows:

TABLE 1

Optometric Findings Taken on Bruce and Brooks

Finding	Bruce	Brooks
Previous Rx.	R. +1.00 D.S. L. +1.00 D.S.	none
Ophthalmometer	R. 41.75 @ 180 42.12 @ 90 L. 41.62 @ 180 41.75 @ 90	R. 41.12 @ 180 41.50 @ 90 L. 41.12 @ 180 41.37 @ 90
Static retinoscope	R. + .75 L. +1.00—.25 × 180	R. +.75—.25 × 150 L. +.50
Binocular subjective	R. +1.00—.12 × 180 L. +1.00—.25 × 180	R. +.75 L. +.75—.25 × 40
Visual acuity uncorrected	R. 20/15 L. 20/15	R. 20/15 L. 20/15
Visual acuity corrected	R. 20/15 L. 20/15	R. 20/15 L. 20/15
Lateral phoria at distance	orthophoria	orthophoria
Lateral phoria at near	1Δ esophoria	4Δ exophoria
ACA ratio	6.4	4.4
Color vision	normal	normal

OPHTHALMOMETER FINDINGS

The ophthalmometer findings can be analyzed both in terms of corneal curvatures and in terms of corneal astigmatism. In regard to the corneal curvatures, these may be analyzed by comparing curvatures in each of the principal meridians for the same-sided eye of each member of a pair of twins. The differences in corneal curvatures between the two members of each pair of twins are given in Table 4, part A. In each case the differences are in the same direction, i.e., Bruce's curvature greater than Brooks,' and so forth. It can be seen from this table that the differences in corneal curvature were the least for Kay and Gay, neither of whom wore a correction: were slightly greater for Bruce and Brooks, Bruce having worn a correction for four months: and

TABLE 2

Optometric Findings Taken on John and James

Finding	John	James
Previous Rx.	R. +2.00—.75 × 178 L. +1.75—.50 × 180	none
Ophthalmometer	R. 44.25 @ 180 46.00 @ 90 L. 44.00 @ 180 45.75 @ 90	R. 43.75 @ 180 44.75 @ 90 L. 43.50 @ 180 44.50 @ 90
Static retinoscope	R. +1.25— .75 × 180 L. +1.50—1.00 × 180	R. +1.25—.25 × 180 L. +1.00—.50 × 180
Binocular subjective	R. +2.25— .75 × 2 L. +2.25— .50 × 160	R. +1.25—.25 × 10 L. +1.12—.50 × 164
Visual acuity uncorrected	R. 20/20 L. 20/15	R. 20/20 L. 20/20
Visual acuity corrected	R. 20/15 L. 20/15	R. 20/15 L. 20/20
Lateral phoria at distance	4Δ exophoria	orthophoria
Lateral phoria at near	2Δ exophoria	1Δ exophoria
ACA ratio	3.6	5.6
Color vision	defective	defective

were considerably greater for John and James. John having worn a correction for four years.

The experimental error involved in taking the ophthalmometric findings should be considered. Since two separate findings were taken in each case, one would expect very little error in the findings, perhaps no more than ±0.12 D. This being the case, the fact that the differences in curvatures are in the same direction for each of the two meridians, in each case, would seem to indicate that the differences in corneal curva-

TABLE 3

Optometric Findings Taken on Kay and Gay

Finding	Kay	Gay
Previous Rx.	none	none
Ophthalmometer	R. 46.00 @ 180 46.75 @ 90 L. 45.75 @ 180 46.25 @ 90	R. 45.75 @ 180 46.25 @ 90 L. 46.00 @ 180 46.25 @ 90
Static retinoscope	R. + .50 L. + .75	R. +.75 L. +.50
Binocular subjective	R. + .75 L. +1.00	R. +.75 L. +.75
Visual acuity uncorrected	R. 20/15 L. 20/15	R. 20/15 L. 20/15
Visual acuity corrected	R. 20/15 L. 20/15	R. 20/15 L. 20/15
Lateral phoria at distance	orthophoria	2Δ exophoria
Lateral phoria at near	4Δ exophoria	2Δ exophoria
ACA ratio	4.4	6
Color vision	normal	normal

TABLE 4

A. Differences in corneal curvature between the two members of each pair of twins:

	Right Eye		Left Eye	
	Horiz.	Vert.	Horiz.	Vert.
Bruce and Brooks	0.62	0.37	0.50	0.37
John and James	0.50	1.25	0.50	1.25
Kay and Gay	0.25	0.50	0.25	0.00

B. Differences in corneal astigmatism between the two members of each pair of twins:

	Right Eye	Left Eye
Bruce and Brooks	0.25	0.12
John and James	0.75	0.75
Kay and Gay	0.25	0.25

C. Differences in spherical equivalents for retinoscopy findings between the two members of each pair of twins:

	Right Eye	Left Eye
Bruce and Brooks	0.12	0.37
John and James	—0.25	0.25
Kay and Gay	—0.25	0.25

D. Difference in astigmatism for retinoscopy findings between the two members of each pair of twins:

	Right Eye	Left Eye
Bruce and Brooks	—0.25	0.25
John and James	0.50	0.50
Kay and Gay	0.00	0.00

ture found are real and are not due to error involved in taking the findings.

In analyzing the ophthalmometric findings in regard to differences in corneal astigmatism between the two members of each pair of twins, we find that the corneal astigmatism is of the same axis for each of the two members in every case, so we can simply list the differences in corneal astigmatism for the right and left eyes, as is done in part B of Table 4. Here, again, we can see that the differences are greater in the case of John and James than in either of the other two pairs.

STATIC RETINOSCOPY

It is convenient to analyze the static retinoscopy findings both as to the differences in spherical equivalents, and the differences in amounts of astigmatism. The differences in spherical equivalents are listed in Table 4, part C. Here we find no tendency for a greater difference in findings between John and James than between the two members of each of the other pairs of twins. It should be noted that in the findings for John and James, and for Kay and Gay, the differences are not in the same direction for both eyes: that is, one twin's finding may be more plus for the right eye, but less plus for the left eye, than that of his fellow twin. This can be interpreted as an indication that the differences may be attributed at least partially to experimental error, particularly if we regard the retinoscope finding as accurate to about ± 0.25 D., as reported by Shepard.[5]

TABLE 5

A. Differences in spherical equivalents for binocular subjective findings between the two members of each pair of twins:

	Right Eye	Left Eye
Bruce and Brooks	0.12	0.25
John and James	0.75	1.12
Kay and Gay	0.00	0.25

B. Differences in astigmatism for binocular subjective findings between the two members of each pair of twins:

	Right Eye	Left Eye
Bruce and Brooks	0.12	0.00
John and James	0.50	0.50
Kay and Gay	0.00	0.00

C. ACA ratios, and differences in ACA ratios between the two members of each pair of twins:

	ACA Ratios	Difference
Bruce	6.4	
Brooks	4.4	2.0
John	3.6	
James	5.6	2.0
Kay	4.4	
Gay	6.0	1.6

An analysis of the retinoscope findings as to differences in the amounts of astigmatism is shown in part D of Table 4. Here we find the greatest differences are those for John and James, although these differences are not as great as were those for corneal astigmatism.

BINOCULAR SUBJECTIVE FINDINGS

The binocular subjective findings may also be analyzed in terms of both the differences in spherical equivalents, and the differences in amounts of astigmatism, as shown in Table 5, parts A and B. As to the spherical equivalents, we find that the differences are very pronounced for John and James, whereas the differences in spherical equivalents for the retinoscope findings for the same twins were of such a nature that they could easily be attributed to experimental error. The differences in subjectively determined astigmatism are also more pronounced for John and James than for either of the other two pairs of twins. The amount of differences for each eye, 0.50 D., is the same as that found for the retinoscope findings.

VISUAL ACUITY FINDINGS

No particular significance should be attached to the visual acuity findings, since all the subjects were either hyperopes or compound hyperopic astigmats, all having adequate accommodation to achieve either 20/20 or 20/15 vision.

LATERAL PHORIA FINDINGS AND THE A.C.A. RATIO

Inasmuch as, for the purposes of this paper, the lateral phoria findings are important only in enabling one to determine the A.C.A. ratio, they will not be discussed as separate findings. Table 5, part C,

lists the A.C.A. ratios, together with the differences between A.C.A. ratios for the two members of each pair of twins. It is obvious that the A.C.A. ratios of John and James are not significantly less similar than those of Bruce and Brooks or those of Kay and Gay. In seeking an explanation as to why John required a correction and James did not, the comparison of A.C.A. ratios, then, will yield little information.

In order to evaluate the fairly large differences between the A.C.A. ratios for the two members of a pair of identical twins, it may be helpful to consider the available evidence concerning the amount of error involved in taking the findings which are used in computing the A.C.A. ratio, namely, the distance and near phoria findings. Shepard[5] gives 1.5Δ as the standard error of measurement for the distance phoria, and 2Δ as that for the near phoria. Fry and Haines[6] give these standard errors as 2.1Δ and 4.1Δ, respectively. Manas and Schulman,[7] reporting on 20 measurements taken on each of 22 subjects, report standard deviations of 1.12Δ for the distance phoria, 1.97Δ for the near phoria, and 1.97Δ for the quantity (distance phoria - near phoria). The reason for considering the standard deviation of the quantity (distance phoria - near phoria) is that the A.C.A. ratio depends upon this quantity and is, in fact, proportional to it. By using the value 1.97Δ for the above quantity, we can calculate that the standard deviation of the A.C.A. ratio would be 0.8Δ. Similarly, the standard errors reported by Fry and Haines would lead us to assume a value of approximately 1.6 for the standard deviation of the A.C.A. ratio.

The difference between the A.C.A. ratios of the two members of each of the three sets of twins, then, is equal to or greater than the standard deviation of the A.C.A. ratio. In order to say with any degree of certainty that the findings are really different, they should differ by at least two, and preferably three, standard deviations. The differences in A.C.A. ratios as listed in part C of Table 5, therefore, are of such a nature that we cannot say with any degree of certainty whether they represent, in each case, chance variations from a single A.C.A. ratio, or A.C.A. ratios that are really different.

COLOR VISION TEST

Of the three pairs of twins, Bruce and Brooks and Kay and Gay were found to have normal color vision, having named all color plates correctly. John and James, on the other hand, were both found to have defective color vision, each having named more than half the color plates incorrectly, and each having made mistakes on identical plates. These results, of course, are not unexpected, since it is quite well agreed among authorities that color vision is a genetically determined trait.

DISCUSSION

The results of this investigation, as analyzed above, pose the following questions:

1. Why is there a consistent difference in corneal curvatures between the two members of a pair of identical twins? Should we be surprised to find this difference, which occurred in all three cases?

2. How are the differences in corneal curvatures between the two members of a pair of identical twins related to the differences in their refractive errors?

3. How can we account for the fact that John and James had very similar retinoscopic findings as far as spherical equivalents were concerned, but had markedly different ophthalmometric findings, binocular subjective findings, and phoria findings? How can we account for the fact that John has worn a fairly strong correction for several years while James has not worn a correction at all, in the light of the similar retinoscopic findings?

4. Since the differences in A.C.A. ratios are such that we cannot say with any degree of certainty that they are the same or that they are really different for the two members of each pair of twins, what can we say about the relative influence of genetic and environmental factors in the determination of the A.C.A. ratio?

Attemping to answer the above questions is of course conjecture to a large extent, but there is probably something to be gained in the attempt.

1. There is little doubt that the corneal curvatures are really different, particularly for the first two pairs of twins, since they differ by more than twice the error of measurement. Hofstetter and Rife also found little similarity in corneal curvatures of identical twins, their scatterplots of the corneal astigmatism findings showing virtually no correlation. In attempting to evaluate the relative influence of heredity and environment on corneal curvature, it may be helpful to consider the fact that one does not necessarily expect the two members of a pair of identical twins to be *exactly* the same in all physical measurements. For example, we would probably not be particularly surprised to find that one twin may be ½ inch taller than the other; it will probably be agreed that ½ inch bears about the same relationship to the total possible range of heights as does 0.50 D. to the total range of corneal curvatures.

2. One might assume that an eye having a higher corneal curvature would tend to be more myopic. However, both Bruce and John have higher corneal curvatures than their respective twins, but are more

hyperopic, as shown by the subjective findings. This could lead us to imagine that the smaller, more curved, cornea is accompanied by a smaller eyeball in general and a shorter axial length, thus bringing about more hyperopia instead of less. This possibility is supported by the statements of Stenstrom[8] that axial length is more important than corneal curvature in determining the state of refraction of the eye.

3. The fact that the spherical components of John's and James' retinoscope findings were similar even though the spherical components of their subjective findings were quite different may possibly be explained on the basis of John's esophoria, which would allow him to over-accommodate during the retinoscope test, but to relax accommodation during the binocular subjective test. On the other hand, we can consider the possibility that John's higher binocular subjective finding (and possibly also his need for spectacles) was based upon the fact that he has a greater corneal curvature and a larger amount of corneal astigmatism than does James.

4. The inconclusive A.C.A. ratio data may be explained if we consider the possible factors determining the A.C.A. ratio. Undoubtedly these are numerous, including the innervation, the lengths and positions of insertion of the internal recti, the elasticity of the lens capsules, shapes of the orbits, and so forth. Each of these factors may be subject to minor variations, such as the position of the embryo in the uterus, differences in prenatal nutrition, slight trauma at birth, and other prenatal variables which may be considered to be congenital and not environmental, but yet are *not* genetically determined. More will have to be known about the factors which account for the relationship between accommodation and convergence before we can say that the A.C.A. ratio is determined by genetic factors, congenital factors (which include genetic factors *plus* others), or by environmental factors, or by a combination of these.

It may be well to repeat the statement that when we take the clinical findings necessary for the computation of the A.C.A. ratio, we are dealing with the stimulus to accommodation rather than with the accommodative response. For this reason, it may be that some of the rather large variation ordinarily found in the clinically-determined A.C.A. ratio may be variation in the patient's response to the stimulus to accommodation, rather than actual variation in the A.C.A. ratio. This variation in response to the stimulus to accommodation may account for the different methods of approach to the problem which are well illustrated on the one hand by the statement made by Manas and Schulman that the A.C.A. ratio is a biological variable, varying with

the exigencies of the day, and on the other hand by the comment by Hirsch[9] that the A.C.A. ratio is truly a constant and that any error involved is only error in measurement, comparable to the error that would be involved in measuring the length of a room with a millimeter rule. The results of this investigation do not add weight to either of the above approaches, and thus we may subscribe tentatively to the conclusion that both hereditary and environmental factors may account for the clinically-determined ratio of accommodative convergence to accommodation.

The author wishes to express his thanks to Drs. Robert Cohen, Lewis Bresin, and William Kensler, who took the optometric findings, and to Dr. Edward Les, who provided the subjects.

REFERENCES

1. Rife, David C., Dice of Destiny. Columbus, Ohio, Long's College Book Co., 1945.
2. Hofstetter, H. W., Accommodative convergence in identical twins. Am. J. Optom. and Arch. Am. Acad. Optom., 25 (10) : 480-491, 1948.
3. Hofstetter, Henry W. and David C. Rife, Miscellaneous optometric data on twins. Am. J. Optom. and Arch. Am. Acad. Optom., 30 (3) : 139-150, 1953.
4. Fry, Glenn A., Fundamental variables in the relationship between accommodation and convergence. Optom. Weekly, 34 (6) : 153-155; (7) : 183-185, 1943.
5. Shepard, Carl F., Practical probabilities. Optom. Weekly, 45 (12) : 473-476, 1954.
6. Fry, Glenn A. and Howard F. Haines, Tait's analysis of the accommodation-convergence relationship. Am. J. Optom., 17 (9) : 393-401, 1940.
7. Manas, Leo and Paul Shulman, The variation in the accommodative-convergence accommodation (ACA) ratio upon periodic retesting. Am. J. Optom. and Arch. Am. Acad. Optom., 31 (8) : 385-395, 1954.
8. Stenstrom, Solve, Investigation of the variation and the correlation of the optical elements of human eyes, translated by Daniel Woolf, Pt. 6, Summary. Am. J. Optom. and Arch Am. Acad. Optom., 25 (10) : 496-504, 1948.
9. Hirsch, Monroe J., Editorial footnote. Am. J. Optom. and Arch. Am. Acad. Optom., 31 (8) : 395-396, 1954.

ANNOUNCEMENT

BETA SIGMA KAPPA TO MEET IN WASHINGTON

Dr. Harry E. Pine, Chicago, chancellor, Beta Sigma Kappa, has announced that the annual convention of the fraternity will be held on June 26 at the Shoreham Hotel, Washington, D. C., during the annual Congress of the A.O.A. All fraternity members are urged to attend the B.S.K. meeting and luncheon.

AN APPROACH TO PRESCRIBING CORNEAL TYPE CONTACT LENSES*

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The writer believes that most of us are aware that in the prescribing of corneal type contact lenses we have been, for the most part, prescribing a trade name. We have been prescribing the product of a laboratory without usually knowing the basic construction of the lens being prescribed. In a good many instances we send to the laboratory the ophthalmometer readings and spectacle prescription and leave the construction of the lens to the laboratory. In other instances those who utilized trial lenses simply sent the trial lens number and the lens power, found with the trial lens in place, to the laboratory. Even in these cases the prescriber did not usually know the lens construction. Certainly a fair percentage of success is achieved, but if problems arise how does the optometrist meet them if he does not know the construction of the lens? This paper demonstrates a procedure by which a corneal lens may be prescribed with full information of that lens forwarded to the laboratory for its fabrication.

From the inception of prescribing corneal lenses we were told that the finished lens would be somewhat flatter than the ophthalmometer reading. For example: if the K reading was 45.00 D. we were told to convert the 45.00 D. to millimeters, which would be 7.5 mm., add 0.3 mm. and order a lens 7.8 mm. in radius. If the K reading was sent to the laboratory, the laboratory would arbitrarily add 0.3 mm. to the flattest corneal meridian and fabricate the lens. This procedure was followed because it was known that the cornea flattens as it goes from its apex towards its periphery. While it was known that this peripheral flattening varied, it was not known by how much it varied nor was there any known way by which it could be clinically measured. While the overall success in the prescribing of corneal lenses was greater than the then used scleral fluid lenses, it was not better than about 20%.

With the advent of the micro-type corneal lenses the wearing times as well as the percentage of success greatly increased, but the overall

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†Optometrist, Diplomate, Contact Lens Section, Fellow, American Academy of Optometry.

percentage of success was probably no greater than 35%. By micro-type lenses I refer to single radius lenses about 0.2 mm. thick and about 9.5 mm. in diameter. Significant is the fact that these lenses are prescribed flatter by anywhere from 2.00 D. to 6.00 D. than the flattest corneal meridian with the average about 2.50 D. to 3.00 D. Following the previously mentioned procedure, if one were to send the K findings and spectacle prescription to the laboratory one would receive a pair of lenses 2.50 D. or 3.00 D. flatter, depending on the laboratory. Although there are other reasons why this type of lens construction was prescribed flatter than the corneal lens, the significant reason is because the cornea flattens as it goes to its periphery. Once again, however, there was no way of actually measuring the amount of this change, but some significant facts are known. We learned that several factors were important. Among them were: (1) the overall diameter of the lens; (2) the inside radius of curvature of the lens; (3) the depth and radius of the bevel (if any).

When prescribing the single radius micro-type lens and confronted with a problem, we either made the lens smaller or made the lens flatter. Either method resulted in making the lens looser. In many instances, however, the first lens received from the laboratory proved adequate. However, in some of these cases, which at first appeared successful, corneal abrasions and/or spectacle blur developed. Corneal exhaustion, as well, occurred in cases after some months of wearing. Another interesting experience was that, in a number of cases, the lenses would become tighter as the patient wore them. Even though there is some question as to the possible harm caused by abrasions and spectacle blur it is the opinion of most authorities that these factors should be eliminated. Pascal in *The Optometrist's Handbook of Eye Diseases*, states, "As the surface of the cornea is supplied with several thicknesses of loose cells which regenerate very quickly, any scratch (or abrasion) usually heals within two days. However, there is always danger from infection from the enormous numbers of bacteria which normally inhabit the surrounding tissues and fill the air. This danger is very real and always present. The sequence is sometimes as follows: abrasion of cornea, ulcer, pus in anterior chamber, etc." Spectacle blur can result from a flattening of the tissues of the cornea or edema of the tissues. Either of these may be avoided.

The literature revealed that the average peripheral flattening of the cornea was about ¾ mm. and that the corneal central optical zone was said to be anywhere from 5 - 8 mm. in diameter. Many optometrists were already utilizing lenses with peripheral flattening calling

this a bevel. In a few instances, however, the lenses had true secondary radii. What these secondary radii were, however, was a laboratory secret. In fact it is in only recent months that some laboratories have been describing the construction of their lenses in detail.

In recent months the work of Bier has resulted in a complete reappraisal of the corneal peripheral flattening.[1] In addition to the generally accepted flattening Bier claimed the existence of and described a depressed annulus around the optical zone of the cornea. He called this the "negative zone." The central optical zone is referred to as the "regular zone" and the most peripheral corneal area as the "positive zone." While some authorities question the existence of this negative zone, it is my opinion that this zone does exist and can actually be demonstrated through the use of control (trial) lenses. This, however, is not overly important to the discussion at hand. What is important is the fact that the peripheral flattening of the cornea was becoming increasingly more important until today a great percentage of the lenses being prescribed are double curved lenses, lenses with at least two principal curves. All the laboratories are claiming tremendous success with these lenses and I am willing to agree that the percentage of success is far greater than previously known with a considerable reduction in the occurrence of abrasions, spectacle blur and exhaustion. It seems logical, as well, to prescribe a lens construction which blends with the corneal contours and not one which causes a physical change in the corneal physiology.

Bier claimed that the average flattening of the lenses he used was from 4 - 8/10ths mm. depending on the central radius of curvature of the optical or regular zone. He also claimed that the steeper the cornea the less the difference in flattening and the flatter the cornea the greater the peripheral flattening. Utilizing work I had done prior to Bier's paper and the Bier work on corneal contours, I attempted to determine how this information could best be utilized. I found: (1) Through the use of the ophthalmometer and control lenses we can prescribe not only the optical zone radius of the lens, but the secondary zone radius as well. (2) Through the use of control lenses we can predetermine a patient's ability to adjust to the lenses. (3) Through the use of control lenses we can predetermine the size of the optical zone of the lens. (4) Through the use of control lenses we can predetermine the possible occurrence of abrasions and spectacle blur.

The lens variables with which we are concerned are: (1) the overall diameter, (2) the optical zone radius, (3) the optical zone diameter, (4) the secondary zone radius, and (5) the width of the secondary zone flange.

The corneal variables with which we are concerned are: (1) the radius of the regular zone of the cornea, (2) the diameter of the regular zone of the cornea, (3) the corneal negative zone, and (4) the radius of the corneal positive zone. See Figure 1.

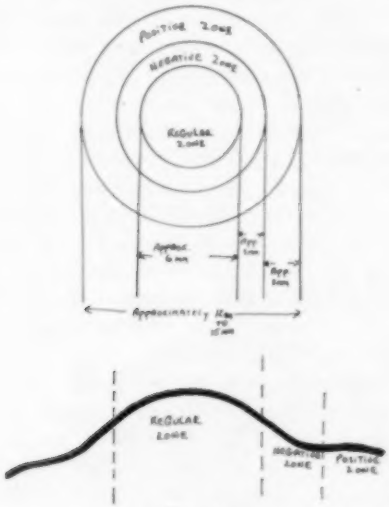

Fig. 1

The basic set of control lenses used by the writer consists of 20 lenses from 7.2 mm. central radius to 8.45 mm. central radius. From 7.2 to 7.7 the lenses are in 0.1 mm. steps and from 8.25 to 8.45 in 0.1 mm. steps. The balance of the lenses have their central radii varying in 0.05 mm. steps. The secondary radii vary from 0.4 mm. flatter in the 7.2 mm. lens to 0.8 mm. flatter in the 8.45 mm. lens. The optical zone diameters vary from 6.5 mm. in the 7.2 mm. lens to 7.5 mm. in the 8.45 mm. lens. The overall diameters vary from 9.5 mm. in the 7.2 mm. lens to 9.7 mm. in the 8.45 mm. lens. The overall averages of the lenses are: (1) 9.65 mm. overall diameter, (2) 7.0 mm. optical zone diameter, (3) 0.6 mm. flatter secondary radius.

Before going into detail as to how this lens construction is prescribed one must decide how the radius of the optical zone of the lens is to match the regular zone of the cornea. The writer will attempt to show why he has adopted the procedure which will be described. Conclusions are based on an analysis of 500 prescriptions as well as more than 200 personal contact lens cases.

The prescriber must decide how the central zone of the lens shall blend with the regular zone of the cornea. The following facts should, however, be kept in mind. The probability exists that if one prescribes a lens, the central radius of which is flatter than the cornea, that the cornea will flatten accordingly creating a less myopic or more hyperopic condition. It also appears that if one prescribes a lens with a steeper central radius than the cornea that the cornea will steepen accordingly and become more myopic or less hyperopic. Certainly the amount of corneal change varies considerably, but the majority of corneas show these changes as "spectacle blur." Most blurring of this type clears within hours, but in some cases it lasts months and some corneas do not ever return to their normal physiological state. I have seen several cases of monocular diplopia resulting from the prescribing of flat lenses. Molding this type of cornea reveals a very definite flattened area between the optical center of the cornea and the superior limbus. Because of the above short resume of the possible effects to the cornea of flat and steep lenses I have been utilizing the following procedure for months with excellent results.

Using the keratometer as a starting point, a lens is selected, the radius of which matches the corneal flattest meridian. Assuming that the "K" finding shows 45.00 D., the selected lens would have a central radius of 7.5 mm. The secondary radius of my control lens is 8.0 mm. The overall diameter of that lens is 9.6 mm. and the optical zone diameter 6.5 mm. If the first lens chosen is correct the fluorescein picture will be as shown in Figure 2. There will be: (a) a dark cen-

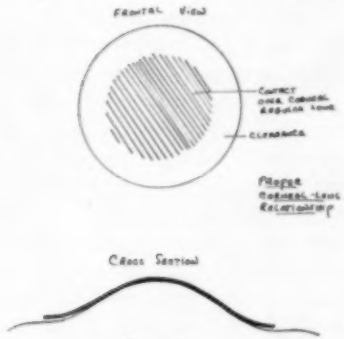

Fig. 2

tral area where the optical zone of the lens conforms to radius of regular zone of cornea, (b) complete clearance around lens periphery (bright green), (c) lens riding centrally or up ½ mm. but never into

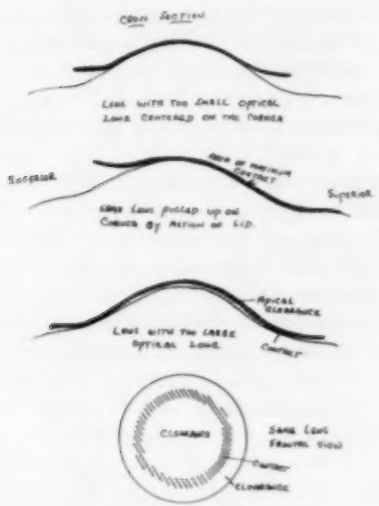

Fig. 3

limbus—on occasion lens may ride down or nasally ½ mm., (d) no dark ring around regular corneal zone.

If the secondary radius is too flat the lens will ride high, while if the secondary radius is too steep there will not be full clearance around the lens periphery (a ring will show). To check, in order to determine the correct fit, simply place the next flatter and the next steeper lens on the cornea and compare the clinical picture. A lens with too steep a secondary radius will, as well, have a green (dull to bright) central picture, while a lens with too flat a secondary radius will have a very dark central picture in the area of touch, as well as riding high.

The next factor to determine is the diameter of the optical zone of the lens. Our study has revealed that this factor is important because a change of ½ mm. in optical zone diameter can affect the clinical fit of the lens. A lens with a too small optical zone diameter will simulate a loose lens. In addition if the lens were to be kept centered on the cornea the peripheral clearance becomes loose with air bubbles, these coming out of the inferior portion of the lens. This lens will ride high causing a minus lacrimal factor. See Figure 3.

The clinical picture of a lens with an optical zone which is too large is one of a tight lens with a possible plus lacrimal factor created. The area of touch is at the transition zone of the lens creating a dark circumscribed area around the optical zone (regular zone) of the

cornea. The plus lacrimal factor is caused by raising the optical portion of the lens off the cornea. Under fluorescein one will see a dark to bright fluorescein pool in the center of the lens depending upon the amount of clearance. A lens prescribed with this fit will result in sealing off the regular zone of the cornea and eventually will result in corneal exhaustion (insult).

We are fortunate that past research permits us a starting point. The control lenses used are sufficient, in close to 85% of the cases, without variation of any of the variables. When it is found that any one of the variables must be altered it is quite simple to determine the amount of variation through the use of steeper and flatter lenses since the radii as well as the overall diameters and optical zone diameters are known values. For instance, let us assume a fit that shows a tight peripheral area. We first double check to determine whether the ophthalmometer finding is accurate. After this is determined we place on the cornea the next flatter lens in the trial set. We know what the secondary radius of this lens is, and providing our fluorescein pattern shows the proper lens/cornea relationship we combine the radius of the central portion of the first lens with the secondary radius of the second lens and have the finished lens fabricated accordingly.

We must be careful that the transition zone of the lens does not "dig in" at the corneal negative zone. This, too, can result in a sealing off of the corneal apex. There are two ways to eliminate this possible problem. The first is to make certain that the diameter of the optical zone of the lens is somewhat larger (½ mm. or so) than the corneal regular zone. The second way is to make the central radius of the lens slightly flatter than the corneal central radius. The only time the second method should be resorted to is when clearance cannot be accomplished by the first method and the slightly flatter lens does not result in a hyperopic spectacle blur.

One important aspect of contact lens practice—visual analysis—seems to be placed in the background when contact lenses are prescribed. We perform all sorts of visual tests during a routine refraction, but when contact lenses are prescribed many of us seem to be satisfied with simple subjective testing. This is one great source of failure in many patients inability to wear contact lenses. We must be as careful, if not more so, when prescribing contact lenses as we are when prescribing ophthalmic lenses.

The author has seen and examined many patients who, although completely comfortable from a physical point of view, could not wear their lenses for any length of time. The symptoms are invariably of the

asthenopic type. Investigation revealed that some fusional problem had been neglected in the correction in the majority of these patients.

In summary it appears that when the corneal contours are properly prescribed for the chance for success is immeasurably increased. Rather than concerning ourselves with the immediate success, i.e., how the patient feels with the lenses at the time they are prescribed, we should concern ourselves with how will the lenses be three months, six months, or a year from the date of prescribing. With this in mind all variables of the cornea and lens must be carefully considered. It appears from the study done by the author that the most important variables are: (1) the radius of curvature of the optical or regular zone of the lens, (2) the radius of curvature of the peripheral zone of the lens, and (3) the diameter of the optical or regular zone of the lens. At this time the only accurate method for overcoming these variables is through the use of control lenses with known radii and diameters.

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REFERENCES

1. Bier, Norman. A study of the cornea in relation to contact lens practice. Am. J. Optom. and Arch. Am. Acad. Optom., 33 (6) : 291-304, 1956.

CORRESPONDENCE

BIBLIOGRAPHY OF MEDICAL REVIEWS

To the Editor:

We would appreciate it if you would publish an announcement of the publication in June of the third annual volume of the *Bibliography of Medical Reviews*.

Review articles listed in Volume 1 and 2 were gathered as a by-product of the *Current List of Medical Literature* operation and were duplicated in the parent publication in another format. With Volume 3, however, the collection of review articles was extended to all of the current journals received by the National Library of Medicine. The result has been the inclusion in Volume 3 of approximately 600 non-*Current List* articles along with the 2300 review articles also listed in the *Current List*.

The 1958 volume of the *Bibliography of Medical Reviews* is arranged by subject with a separate author index and will contain approximately 2900 references to review articles in clinical and experimental medicine and allied fields which have appeared largely in 1957. Copies of Volume 3 for 1958 will be available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at a price presently estimated at $1.25.

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ATTEND THE A.O.A. CONGRESS IN JUNE

The American Optometric Association will hold its annual congress at the Shoreham Hotel, Washington, D. C., June 25-28, 1958. This is one of the important optometric meetings of the year and every A.O.A. member should make a determined effort to attend. By being present he indicates to A.O.A. leadership a substantial measure of interest in the work of the Association and his presence serves as a stimulant to the new officers in the year ahead.

The meeting this year will consist of the usual interesting sessions of the House of Delegates. These may be attended by all members who sit as a rule with their State voting delegation.

Four excellent post-graduate courses will be presented by the following well known Academy educators. These courses are:

Course I. *Contact Lenses.* Instructor Neal J. Bailey, O.D., Ph.D., assistant professor, Division of Optometry, Indiana University, Bloomington, Indiana.

Course II. *Optometric Economics.* Instructor, Frederick Kushner, O.D., Sheldon, Iowa.

Course III. *Styling, Dispensing and Adapting Eyewear.* Instructors, Marguerite Dowaliby, O.D., and Pauline Dowaliby, O.D., El Segundo, California.

Course IV. *Subnormal Vision Aids.* Instructors, Vincent J. Ellerbrook, O.D., Ph.D., professor, School of Optometry, The Ohio State University, Columbus, and Alfred Rosenbloom, O.D., M.Sc., dean, Illinois College of Optometry, Chicago.

All member optometrists who wish to do so may enroll in these courses and their time will be well spent indeed.

The Woman's Auxiliary will have its special program of meetings, luncheons and trips and these always seem to please. This means that you should bring your wife to Washington to enjoy these events. Programs, too, are planned for your children.

In addition to the foregoing, a trip for members and guests has been arranged to points of historical interest in and around the capitol city. Your registration fee of $25 for yourself and $15 for each member of your family includes this trip and a ticket for the annual banquet of the A.O.A.

At the Congress a large number of optical manufacturers will display their latest in frames and lenses, instruments, equipment of all sorts, other materials and books. This commercial exhibition will as usual be one of the high points of interest at the convention.

As a delegate or a visitor you will find this Washington program well arranged and in keeping with a good summer vacation. Plan your trip this year to include the four day A.O.A. Congress. Write now, to the Shoreham Hotel, Washington, D. C., for your hotel reservations.

CAREL C. KOCH

THE SOCIEDAD AMERICANA DE OFTALMOLOGIA Y OPTOMETRIA

When Sputnik I made its debut in outer space, the whole world realized that America was no longer the invincible leader in science. It has been perhaps the greatest modern stimulus to a reappraisal of our progressive outlook.

In the world of the ophthalmic professions a Sputnik I has also now appeared, and this time from Bogota, Columbia, South America. It is in the form of a new society known as the Sociedad Americana de Oftalmologia Y Optometria, or the American Society of Ophthalmology and Optometry.

At a time here in the United States when a group of ophthalmologists have been leading an attack on optometry, these men in South America have banded together for mutual strength and for the future good of the patients served by both professions. Truly the birth of this new society could never have come at a time in history to have made the efforts of these local recalcitrants seem more immature.

The purpose of this society could best be expressed by quoting from the statutes and by-laws:

Article 1. "Sociedad Americana de Oftalmologia Y Optometria" is a scientific association for the purpose of studying and divulging Ophthalmology and Optometry through lectures publications and practical demonstrations. Its aim, thus, is the spreading and perfecting of the means by which human vision is both preserved and improved.

Article 2. The association is composed of specialists in Ophthalmology and Optometry and specialists in other fields closely related to the former.

Volume 1, Number 1, of the official publication of this new society has just been received and is known as THE ARCHIVES OF THE SOCIEDAD AMERICANA DE OFTALMOLOGIA Y OPTOMETRIA. It is patterned after the style of scientific journals and is well edited. Each article is published in the two languages, Spanish and English, so that the international membership can easily avail itself of the material. The first issue has four articles, two by South American ophthalmologists and two by North American optometrists.

Let us hope that this new society will flourish and that its influence will spread rapidly to the United States. Let us agree with Shakespeare when he said, "Let me not to the marriage of true minds admit impediments."

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BOOK REVIEWS

VISUAL ANALYSIS HANDBOOK II. Leo Manas, M.A., O.D. The Professional Press, Inc. Chicago, Illinois. Second Edition. 143 pages. 44 illustrations. $5.00. 1957.

As the author of this book realizes and clearly states in his first chapter, optometrists approach the clinical aspects of their profession from different viewpoints. Manas describes the school of thought which he follows as the "modern" or "functional" one. Although some, feeling that other approaches are equally modern and functional, might object to these terms, this is of little consequence here. It is important, however, that whatever the approach is called, it is only one clinical approach and others do exist. A review of such a book must take this

fact into account and in reviewing such a book a serious critic must consider its appeal not only to those who adhere to the approach but also to those readers who do not.

Manas points out that in this "functional" approach the clinician makes a series of measurements of various ocular functions and these are compared to a series of "expecteds": by applying the results of this comparison to a series of formulas, the present status, the future status if therapy is not instituted, and the therapy itself are determined. This method of analysis of clinical data, Manas clearly states, is complicated and introduces new optometric terminology. Both of these aspects of the system are necessary and not completely undesirable in the opinion of Manas.

The author does not weigh his system against others nor does he prove that his system is superior to other methods of analyzing optometric clinical data. He assumes that the reader is already convinced of this. Therefore, this book is, as the name states, a handbook for those who use the system, and as such it is a good one. Optometrists who already follow this approach or who wish to learn it will find a description of each of the tests, of the way each should be performed, of the significance of these tests, and of the mechanics of case analysis. Finally, there are case examples, a list of questions and answers, and a glossary which is, of course, essential to any system which introduces new terminology. Although in his own optometric practice this reviewer does not apply the clinical approach of Manas, it is apparent to him that such a handbook as this would be of great assistance to those who do. If an optometrist is convinced of the validity of the "functional" approach, he must have some guide to the complexities of the method. The exposition offered by Manas of the method is well done and satisfies this need. It will give an optometrist of this "functional" school the tools he needs to follow the system.

What, then, of optometrists who follow some other method of clinical analysis and who do not follow the "functional" approach? Clearly, this handbook is not aimed at such readers and is not likely to convince members of this group that the "functional" approach is valid or superior. The optometrist who is not following the "functional" approach will find little in the book to cause him to want to change his mode of clinical practice; nor is this a criticism since such an exposition is not within the scope of a handbook.

The optometrist who does not follow this approach will, however, find a "pointer" or isolated idea which he may wish to incorporate into his own more loosely knit clinical approach. The section

on case histories, for example, is of value if for no other reason than that it re-emphasizes the importance of a good case history.

Two criticisms we offer concern bibliographic references and possible typographical errors. These may be illustrated by brief examples. In some of the chapters the bibliographic material is reasonably well presented, but in others it is not. For example, on page 17 the following statement occurs:

> Two criticisms have been leveled against the functional viewpoint. These are: (1) this method of analysis tends to make visual problems seem more complicated than they are, dramatically stated by Morgan, ". . . simple cases are made complicated, and the optometrist made into a Don Quixote charging a windmill." (2) New terms are used or nebulous meanings are given to old terms.

Unfortunately, however, Manas fails to tell which Morgan made the statement, when he made it, and where.

With regard to typographical errors, we are not certain if the inconsistencies we observe are true typographical errors or are facets of the "functional" method with which we are unfamiliar. For example, in "Case Two" on page 122, the subjective finding is given as:

—3.75 —.50 x 80° 20/20
—4.00 —.50 x 90° 20/20

while the prescription is later listed as,

—4.00 —.50 x 90°
—3.75 —.50 x 80°

We rather believe that this is a typographical error, but there may be some rule of which we are not aware that requires shifting lenses eye for eye in certain instances.

Again, on page 123 in "Case 4" the following typographical error or inconsistency appears. All of the retinoscopic tests show a —0.50 D. cylinder, axis 90°. The subjective test yields

+0.50 —0.50 x 90° 20/20

The corrective framework is:

far: not over: +0.25 —0.50 x 90°
not under +plano —0.50 x 90°

The prescription is:

+0.75
+0.75

Here again there is a question in the reviewer's mind as to whether the cylindrical component is omitted from the prescription as part of the "functional" approach or whether it was omitted accidentally when the type was being set.

Another misprint is that found in the last paragraph on page 113, "If the test ended in a break before the blur, as shown by an 'X' in

the analytical examination form, the amount of the break is estimated from the blur finding, although this is merely an approximation." What this says is nonsense although anyone with understanding will know what it probably means.

In closing this review it might be pointed out that aside from Kehl's manual *Analytical Optometry Work Book*, this new handbook by Manas is the only available source of information dealing with O.E.P. methods available for teachers in schools of optometry.

MONROE J. HIRSCH, O.D., PH.D.

PRINCIPLES OF PERCEPTION. S. Howard Bartley, Ph.D., Published by Harper & Brothers, New York City. 482 pages. Illustrated. Cloth. $6.50. 1957.

The author points out that this book is "Planned for those who, by traditional definition, are experimental psychologists, and also for social psychologists. The book will be of professional interest to those in the field of optometry and related fields."

Besides reporting on experimental findings, the book's purpose is to develop an outlook that will be serviceable in both general experimental and systematic psychology. The text treats, in a self-consistent way, much material that has existed in unrelated fragments, and builds on the premise that a consistent and clear terminology is necessary for carrying on science.

For instance, the reader is introduced to the need for employing separate sets of words to name stimuli and to name responses. The explanation of perception here is shown necessarily to lie in processes outside of perception itself. This concept of perception covers both what the older psychology called sensation and what is now called the awareness of objects. Perception in both respects is shown to be variable, one factor in the production of this variability being the social context in which the individual is found.

The book thus differs from the usual study of human senses, since it attempts to deal with perceptual response as the behavior of a person —a relating of a person to his environment. The author's definition of psychology is the study of the organism as a person. Perception is, therefore, treated as being personalistic, even though accounted for by the stimulus, and, to a great extent, by physiological processes within the organism.

In the chapter devoted to Space Perception the optometrist will find the following in reference to cheiroscopic drawings. "The observer may not see the object as the size it would be expected to be

from what we know about the target. Cheiroscopic drawing is one of the best demonstrations of this, when the drawing does not match the target in size or in position. It is by such a drawing that a vision expert can tell whether the patient has a 'visual problem.' A visual problem is the general name given to the condition of visual inefficiency existing when the person does not quickly (directly) and accurately locate objects in space. His whole behavior is shot through with inaccuracy, secondary corrective movements, etc., when space localization is shown to be faulty by such tests as cheiroscopic drawing. When we say that an observer is dealing with 'objects in space' let us remember we are not reverting to the common implication that space is populated with solid external objects in a physical sense."

This quotation suggests why the book will be interesting reading for optometrists generally. The reader who devotes any considerable time to orthoptics or visual training will find Bartley's book an important addition to his library.

RUDOLPH H. EHRENBERG, O.D.

OPTICAL AIDS FOR LOW ACUITY. Russell L. Stimson. Braille Institute of America. Los Angeles, California. $10. 1957.

The purpose of this publication is the presentation of a simplified procedure for the measurement of visual acuity at the near point and the selection of an appropriate magnifier for the visual needs of patients. As such, the publication is a manual rather than a textbook; its essential role is "how to do it" rather than a consideration of principles and basic scientific tenets upon which adequate optometric care of the partially sighted is founded. This design did not accrue by accident; it was a specific objective of the author and this cannot be construed as a shortcoming of the manual.

A major problem in the optical aid of the partially sighted is the selection of one or more magnifiers to meet the needs of a patient. This problem chiefly stems from the varying needs, not only of different patients, but also of the same patient, but for different visual tasks. Visual resolution alone may vary from the equivalent distance visual acuity of 20/70 to mere finger counting at a few inches from the eyes. Almost as numerous is the variety and choice of aids to meet the visual needs of the patient.

It is obvious that one approach to this problem is simply the trial and error method. With this procedure, the practitioner determines the minimum power of one or more magnifiers to enable a patient to perform the desired visual task. Although there are several definite

advantages to this method, it is time consuming and often times leaves the patient with the feeling that he chose the aid rather than the practitioner having prescribed the aid for him. The procedure described by the author avoids both of these problems. By use of various plates in the manual, the visual acuity at the near point readily can be determined. Reference next is made to tables which provide the power of the magnifiers and reading distance to perform various visual tasks. Then one simply consults the extensive list of the available magnifiers of various powers and makes the appropriate selection.

The acuity charts in the manual are unique in several respects: one series consists of three discs of equal size arranged in triangles. One of the areas is similar to a target of bull's eyes, that is, it is composed of concentric circles separated by spaces equal to the width of the lines. The narrowest lines subtend an angle of 1′ when viewed at 35 mm., and the widest lines subtend an angle of 45′ at the same viewing distance. The other two discs in each group are shades of neutral gray that closely simulate the density of the target when it is out of focus.

The second design of charts is similar to the conventional Snellen test except that it is extended to permit the measurement of acuity as low as 35/15554. All of the charts are expertly printed and each plate is provided with an edge index for ease in use and location.

Without question, the material in this manual is very useful in the design of eyewear for the partially sighted.

V. J. ELLERBROCK, O.D., PH.D.

SCHOOL OF OPTOMETRY
THE OHIO STATE UNIVERSITY
COLUMBUS, OHIO

A GUIDE TO STATISTICAL CALCULATIONS. Harold E. Yuker, Ph.D. G. P. Putnam's Sons, New York City. 95 pages. $1.95. 1958.

The clinical and scientific orientation of medical and optometric training leaves little room for familiarizing oneself with statistics, yet the practitioner often needs some statistical knowledge for the interpretation of studies and research projects in which he is involved.

Dr. Yuder's new book should find wide acceptance among members of these and allied fields since it is intended for the use of those who are "non-mathmatically oriented." The various measures, such as Chi Square, Standard Deviation, etc., are defined and interpreted, and step by step directions are given for their calculation. The only mathmatical knowledge required is familiarity with addition, subtraction, multiplication and division, and, as Dr. Yuker points out, even this

can be done with a calculating machine if necessary.

While this reviewer thinks primarily of the use of the book in the fields of optometry and medicine, it would be of considerable value as well to those in biology, psychology, education, sociology, mathematics, economics and business. It is a very worth while book to have.

THOMAS H. EAMES, ED.M., M.D.

SCHOOL OF EDUCATION
BOSTON UNIVERSITY
BOSTON, MASSACHUSETTS

OCULAR ANATOMY. J. D. Spooner, F.S.M.C., F.B.O.A. (Hons) The Hatton Press, London, England. 226 pages. 236 illustrations. $6.50. 1957.

Mr. Spooner has written an excellent text in which he discussed the anatomy, histology, embryology, ontogeny of the human eye and related structures. The subject matter is well organized to give the reader an opportunity to grasp the fundamental anatomical structures with a minimum of terms and descriptions. The author has taken the time to arrange the subject matter in a logical sequence leading the reader from one structure to the next in an interesting and comprehensible fashion.

The illustrations, diagrams, and photographs by themselves are worth the price of the book. The illustrations have a three dimensional quality seldom seen in an anatomical text. Optometrists having these illustrations could easily explain to their patients many of the structures of the eye and their functions.

Other features of the text which are written for the student presents an excellent review of the oculo-rotary muscles. Sections are devoted to such important considerations as the neuro-anatomy of the eye, metabolism of the eye, dissection of the mammalian eye, histological methods, microscopy, and staining methods.

The text also serves as an excellent review for those studying for state board examinations and as a means of patient orientation to their ocular conditions.

H. S. WODIS, O.D.

ILLINOIS COLLEGE OF OPTOMETRY
3241 S. MICHIGAN AVENUE
CHICAGO, ILLINOIS

CURRENT COMMENTS

Terry Judith Parkins
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

ILLINOIS COLLEGE OF OPTOMETRY APPOINTS ORBACH

The Illinois College of Optometry announces that Dr. Jack Orbach has joined the faculty of the College and will be teaching in the area of visual psychology.

Dr. Orbach was born in Montreal, Canada. He received his B.A. and M.A. degrees from McGill University in 1949-50 and his Ph.D. degree in Psychology from Princeton University, in 1954. His Master's thesis was entitled, "Retinal Locus as a Factor in the Recognition of Visual Perceived Words." His Ph.D. thesis was entitled, "Effects of Removal of Visual Cortex on Learning and Retention in the Monkey." He received an Academic scholarship in 1946-47, and a Graduate Fellowship at McGill University, 1949-50; a Graduate Fellowship at Princeton, 1950-51; and an N.R.C. Fellowship in the Medical Sciences, 1955-57. He is, at present, a research psychologist at the Psycho-Somatic Institute, Michael Reese Hospital, Chicago, and his studies in research are investigating Perception in relation to Brain.

Dr. Orbach is at present, a member of the A.A.A.S., Sigma XI and the A.P.A.

NEWS FROM SUPPLIERS

New York City. The Better Vision Institute reports that 15,124 school eye charts were distributed during 1957. The demand continues for these with more than 1,200 of them being ordered each month during 1958. Optometrists should be sure that each grade school in their area has one or more of these fine large charts that do such a good job of focusing attention on the need for proper eye care. The B.V.I. will supply the charts for $1 each. Write, 630 Fifth Ave., N.Y.C.

Rochester, N. Y. The Bausch and Lomb Optical Company are celebrating the 40th birthday of the starting of their ophthalmic lens glass making plant. This glass manufacturing development in Rochester, which was started at the beginning of World War I, brought out the first ophthalmic glass made in the U.S.A.

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Replacing the annual "Hell Week" to "Help Week," the pledges of the Omega Delta fraternity, or better known as the "Chain Gang," became the Michelangelos' of Illinois College of Optometry. They took on as their project to clean and re-decorate the reception room, director's office, dispensing room, and the hallways of the main clinic. At the same time the library of the Illinois College of Optometry has donned a new dress. New shelves, a storage rack, librarian's desk and card files, reserve cases, pamphlet and perdiodical display shelves, have been installed. . . . During the past month new spectacle frames were announced by American Optical, Shuron, Liberty and Marine. The Opticase Company has brought out a new foam rubber lined spectacle case and Bausch and Lomb has announced a covered rigid aluminum case with a pocket clip. The Phillips Lens Company now has a new 10-day factory-to-laboratory service on special order one-piece bifocal lenses. . . . The Therminon Lens Company, 63rd and University, Des Moines, Iowa, have just published some new literature dealing with their infra-red absorption lenses and why these should be widely used by patients everywhere. If you have not received this material you may write to them and copies will be sent promptly. . . . The Plastic Contact Lens Company, 59 E. Madison St., Chicago, announces the 1958 Miss National Contact Lens contest. Optometrists may enter their young women contact lens wearing patients. For details as to what to do, write the company. . . . The Titmus Optical Company have just issued a new eight page catalogue dealing with its new line of absorptive lenses. . . . The Bausch & Lomb Optical Company will soon issue a new film dealing with children's visual problems. It will be called "Report Card on Vision" and will be available for showing at P.T.A. meetings, luncheon clubs and similar gatherings. . . . Dr. Monroe J. Hirsch (our associate editor) was elected Mayor of Ojai, California, as a result of the last municipal election. Mayor Hirsch accepted the gavel at the April 15 meeting of the City Council and has been hanging on for dear life ever since. . . . Drs. John Collins Neill, Philadelphia, and Bernard Mazow, Houston, head the list of speakers at the Southwestern Contact Lens Congress, Waco, Texas, June 7-9. There is still time to register for this outstanding clinical meeting and all optometrists are invited.

Something of Value

The birth of contact lenses from the time of its conception has been a wonder to behold. It has indeed been a short time from its conception, gestation, and birth. It behooves us to study each one of the many facets of this infant.

For years we have noticed the need for adequate fees in contact lens work. Contact lenses are priceless and command a commensurate fee. This work must be truly done on a high professional plane. Those who have tried to cheapen contact lenses soon found their contact lens work diminished.

In addition, do not forget the great amount of charity work that must be done . . . most of the time without charge. We in the laboratory have recognized this and have made up lenses without charge on your say-so whenever this was necessary. Wherever you have lowered your fee on these charity cases, we have proportionately done the same at the laboratory level. In this manner many subnormal vision cases have been helped to resume their work in a normal world.

Those of us who have grown old in this work realize more than ever that patience, skill, knowledge, motivation, psychology, dedication and many other fine traits are necessary for the continued success and growth of a contact lens practice. The mere thought of placing something on the eye is a great deterrent in the fitting of contact lenses. Time and patience are required to fit a contact lens patient if everything goes well. We know the time and skill required will have to be increased tenfold if the case is difficult. Too many forget the time required in patient follow-ups.

Not only is there a tremendous responsibility upon the practitioners but also on the laboratories. This is especially true in grinding and polishing plastic which is a difficult medium to handle. Contact lenses are constantly being made smaller and thinner with the addition of many secondary curves. Molding involves tremendous investment and research. All these factors require a greater skill in maintaining tolerances. We know that these changes are exacting and costly today in the manufacturing process but we do not spare time nor money in order to aid progress.

This teamwork between the practitioner and the laboratory is an important one for the patient, and we will do everything possible to uphold our part.

Let's solve our contact lens problems together for the benefit of all mankind.

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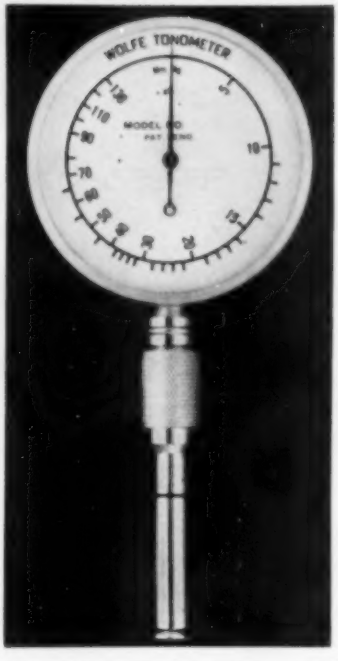

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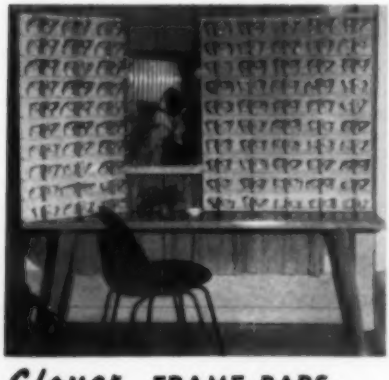

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> *"To honor the technical scholarship of Charles Sheard, professor of Biophysics at the Mayo Foundation and recipient of several medals for distinguished service in the field of optics, this volume reprints a few examples of his many books and articles in the area of ophthalmological and optometrical sciences. The highly technical text studies astigmatism; prisms; skiametry; bifocal, trifocal, and contact lenses; nonphotophobic individuals; illumination and vision; tolerance of light, and related topics. There are many . . . tables, statistics, formulas, and case histories. The appended bibliography lists of 298 items written by Dr. Sheard in standard optical and medical journals, in textbooks and in brochures."* – Books from the U.S.A.

Dr. Sheard was formerly editor of the *American Journal of Physiological Optics* and for many years director of the Department of Biophysics, The Mayo Foundation. The book contains 83 illustrations, 476 pages, $15.00.

CONTENTS

SECTION ONE – Selections from Editorials and Short Essays. SECTION TWO – Dynamic Ocular Tests. SECTION THREE – Dynamic Skiametry and Methods of Testing the Accommodation and Convergence of the Eyes. SECTION FOUR – Considerations Regarding the Analysis and Interpretation of Data on Ocular Accommodation and Convergence; Zones of Ocular Comfort. SECTION FIVE – Ophthalmic Optics with Applications to Physiological Optics. SECTION SIX – Ocular Photosensitivity and Dark Adaptation. SECTION SEVEN – Personalia.

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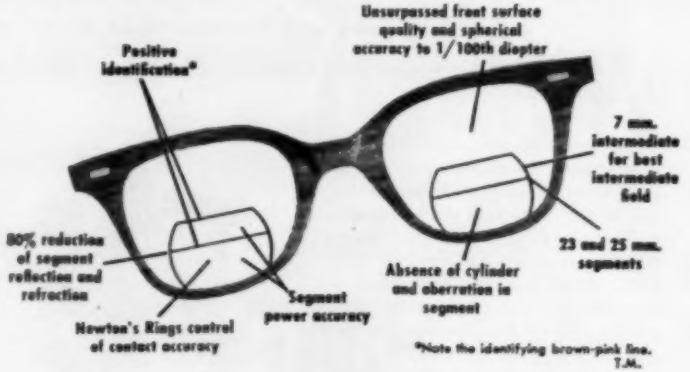
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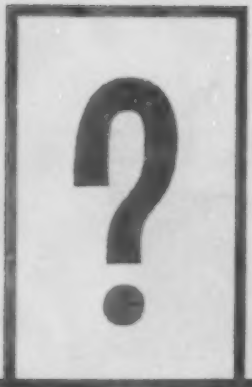

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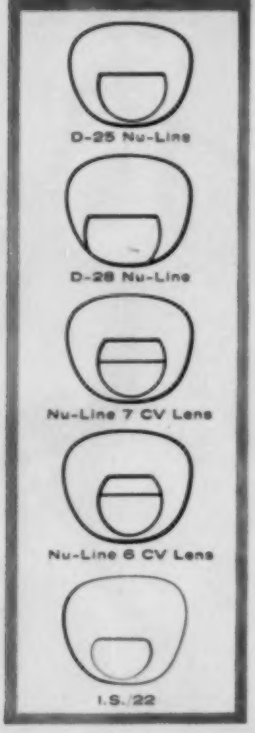

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